IBM

Reference Manual
IBM 7080 Input/Output Control System
for use with 729 Magnetic Tape Units
IOCS80

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PREFACE

Purpose of This Manual

This manual has been prepared to give programmers a thorough working knowledge of the preassembled 7080 Input/Output Control System. This IOCS is designed for use with 729 Magnetic Tape Units. A firm effort has been made to avoid going into detail on the internal workings of the system. This has been done in order that the manual may better accomplish its two main purposes:

1. To explain the programming functions that IOCS will accomplish for an object program.

2. To explain how the programmer may use IOCS in conjunction with his object program.

Assumed Prior Knowledge

To further simplify the description and eliminate unnecessary details, this manual assumes a prior knowledge of the 7058 Processor, the 7080 Data Processing System, and tape format specifications for the 7080.

Anyone without this prior knowledge is advised to read the following publications before attempting to read this manual:

Reference Manual, "IBM 7080 Data Processing System," Form A22-6560

Reference Manual, "7058 Processor: Autocoder III Language," Form C28-6224

Reference Manual, "Autocoder III – System Operation," Form C28-6062

Bulletin, "IBM 705/7080 Applied Programming Tape Format and Labeling Standards," Form J28-6123

A knowledge of the contents of the Reference Manual, "Input/Output Control System for the IBM 705 III," Form No. C28-6109, which contains a complete presentation of the concepts of that system, will facilitate the study of this manual, since the two systems are compatible to a great degree. However, since there is not 100 per cent compatibility, the user should obtain the required details from this manual.

Users of the 705 III IOCS wishing to adapt their programs to use of the 7080 IOCS are referred at this point to Appendix 1 of this manual, "Relationship of 7080 IOCS to 705 III IOCS." This section outlines in detail the major differences between the two systems, and the necessary procedure for conversion of programs using the 705 III IOCS (IOPKGB) to the 7080 IOCS.

IMPORTANT PROGRAMMING CONSIDERATIONS

1. When using IOCS, the 7080 must be in the 7080 and interrupt modes. The object program must not leave the interrupt mode (LIM).

2. All channel tape operations must be accomplished through IOCS.

3. IOCS uses tags which begin with the letters IO or CS. Object programmers should therefore avoid the use of such tags to avoid duplication.

4. The macro-instruction IOCS must precede any other IOCS macro-instructions in each assembly.

5. When the preassembled IOCS is used, the object program must be assembled separately. After assembly, the two decks are combined. Since there will be operands in the object program which refer to IOCS tags, a table of associated tags will be included in the assembly of the object program through the generation of the IOCS macro-instruction.

6. Any programmer using the IOCS who wishes to use Interrupt Keys 252 and 253 to permit operator decisions, should use the IODEC macro-instruction for this purpose rather than an object program routine.

7. The Leave Eighty Mode instruction (LEM) should be used only with great caution. If the object programmer must Leave Eighty Mode, he must Enter Eighty Mode (EEM) again prior to any functional linkage to IOCS.

8. Unlike IOCS (entry and exit via TIP and LIP), the Get/Put system does not preserve the setting of the starting point counter. The funtions of Get and Put are accomplished outside of interrupt program. If the Get/Put system is used and the starting point counter must be preserved for the object program, the programmer must use the SAVE operand in the IOGET, IOPUT and IOBSD macro-instructions. In this case, the macro-generator will include the coding necessary to save and restore the starting point counter.

9. The object programmer should avoid the use of Storage Banks 2 (the Channel Word Set) and 3 (the Channel Auxiliary Storage Units-- CASUs), except as noted below, since IOCS will make extensive use of these storage banks.

10. The object program must not leave interrupt program (LIP) nor issue a functional linkage to IOCS when it (the object program) receives control from IOCS to execute a specialized routine (header transfer address, end-of-reel and end-of-file transfer address, IOTRSOPLBL, IOREDUNCHK). Since at this point the 7080 is in interrupt program,

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the starting point counter is set above 2000. In these cases, the object programmer should use CASUs 9, 13 and 14 for any storage requirements he may have during the execution of these routines. These CASUs may be used in any way the programmer desires, provided they are not set to lengths which would destroy other CASUs. If more storage is required, CASUs 1-6 may be used, provided their settings are restored to 1-6 respectively. To satisfy any additional storage needs, the object programmer must save and restore Storage Banks 0, 1 or 3.

INTRODUCTION

What Is IOCS?

The Input/Output Control System is a group of routines which can be used in conjunction with an object program to handle all input/output functions through the channels of the 7080.

The use of IOCS will eliminate much of the time and effort normally required for machine-oriented programming. This increases the effectiveness of a programming staff by permitting it to devote a greater portion of its time and efforts to installation-oriented programming. Savings can also be effected in both programmer time and machine time by the virtual elimination of the debugging normally required for input/output routines.

In addition, IOCS uses programming and operating standards which facilitate communication among programmers, and enable console operators to more readily familiarize themselves with certain conditions which are identical for every program.

Techniques employed in IOCS are based on the experience gained by DS Applied Programming, both in its own programming efforts and in its contacts with a large number of established installations, and with the engineers who designed and built the 7080. These techniques are directed toward providing efficient programming steps, efficient use of the interrupt feature and buffering capabilities of the 7080, and accurate detection and correction of errors.

Sections of IOCS

The various IOCS routines are contained in seven component sections of IOCS. These sections are listed below, along with a brief description of their corresponding functions. A more detailed explanation of each section is provided later in this manual.

Data Travel System (CSDTS)

This section of IOCS executes or schedules for execution (depending on the availability of the channels) all input/output operations required for data tape records. It also checks these operations for errors, tape marks and reflective spots. Should any of these conditions exist, CSDTS will link to another section of IOCS for execution of the appropriate routines.

Error Correction (CSERR)

If an error is detected following the execution of an input/output operation by IOCS, this section of IOCS will perform the appropriate corrective procedures.

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Tape Reel Control System (CSTRS)

> This section of IOCS checks and positions each tape used by the object program.

End of File and End of Reel (CSEOF)

> This section of IOCS performs all necessary operations when end of file and/or end of reel is reached on input and output tapes.

Memory Record (CSMRD)

> This section of IOCS records on tape the status of the computer at specified points during a production run so that, if necessary, the computer and program may subsequently be restored to their exact status at the time the tape record was made.

Get/Put

> Get/Put provides for the movement of data records between work areas and input/output areas. One of its most important functions is the deblocking of input data records and the blocking of output data records. It also provides for automatic handling of input/output area alternation and reading and writing of tape records. Get/Put is an optional feature of IOCS, and differs from other sections in that it is not a part of the IOCS program deck. If Get/Put is specified by the user, it is incorporated into his object program at assembly time.

Housekeeping (CSHSK)

> This section of IOCS handles all phases of input/output initialization required by the object program. It also initializes all component sections of IOCS.

The Preassembled IOCS

> This manual describes the complete version of IOCS, available in pre-assembled form for use on a four-channel 7080 (IOCS80). Three other versions of IOCS may also be secured by users wishing a smaller package. These versions are IOCS82, IOMS80, and IOMS82. A detailed description of these versions of IOCS appears in Appendix 2 of this manual.

> Since this manual describes IOCS80, the reader should bear in mind that many references to certain options and features of IOCS, as well as descriptions of functions performed by IOCS, may not necessarily apply if the IOCS he uses is one other than IOCS80.

IOCS and the Object Program

Since IOCS is an established group of routines, some sort of communication must be established between it and the source program if the programmer wishes to use IOCS. This communication is provided mainly in four ways by the user in his source program:

1. Tape Table

2. File Tables

3. Functional Linkage

4. Specialized Routines

Tape Table

The Tape Table describes the use of each tape drive which can be attached to the 7080 channels, and is assembled with the source program.

File Tables

File tables contain all information required by IOCS for each file used by the source program, and are assembled with the source program.

Functional Linkage

Functional linkage is provided by means of special macro-instructions. The coding of these macros at logical points in the source program will result in the generation of appropriate linkages into IOCS during object program time for all input/output or other tape movement requests.

Specialized Routines

These routines, coded by the user as a part of his object program, are exited to by IOCS at various stages of a program run. They will contain specific operations the user wishes to perform at certain points in a program, such as beginning or end of file, beginning or end of reel, error correction, etc.

Efficient Use of the Interrupt Feature

When IOCS is used in conjuction with an object program, full use is made of the automatic interrupt feature of the 7080.

Most IOCS processing occurs with the 7080 in interrupt program status. When an input/output (read or write) request is made, main program processing will not be held up waiting for the I/O operation to be completed.

In most cases, the I/O operation will be started, and main program processing resumed while the I/O operation is being executed. When an input/output operation is completed, an automatic interrupt will occur, generally resulting in the next scheduled I/O operation being started.

In other words, IOCS will see to it that maximum use is made of all tape drives in the program, and that as much overlapping of I/O time and processing time as possible is effected.

A Basic Use of IOCS

The following description of a typical program using the preassembled IOCS at object program time is provided to give the reader a broad picture of the relation between the object program and IOCS. To make the description as simple and brief as possible, a number of assumptions are made. For example, it is assumed that standard labels and the Get/Put mode of data movement are used by the object program, and that priming of input areas has been specified. In such a case, the program would proceed as follows (see flow chart, Figure 1):

The object program first links to CSHSK through the macro-instruction IOLNK to CSHSK. (The execution of IOCS housekeeping is required prior to any functional linkage to IOCS.) CSHSK checks and makes various modifications to the tape table, file tables, and IOCS itself.

On each input tape, the header label is checked to make certain that this is the required input file. The first "N" records are then read into the input areas. (N is the number of input areas specified in the file table.)

On each output tape, the old header label is checked to make certain that this tape can be used for current output. A new header is then created.

On conclusion of the housekeeping functions, control is returned to the object program, just beyond the linkage into CSHSK.

Since input areas have been primed, the object programmer now need only move a record from the input area to the work area to begin processing. This may be done by means of the special macro-instruction IOGET. In addition to moving a record from the input area into the work area, the IOGET macro will also issue read requests to IOCS when required. In the case of unblocked records, this will occur each time the IOGET macro is executed. In the case of blocked records, this will occur when the final record in the block is moved from the input area to the work area.

After the record is moved to the work area, control is returned to the object program, and processing begins. Upon completion of processing by the object program, the record may be moved from the work area to an output area by means of the IOPUT macro-
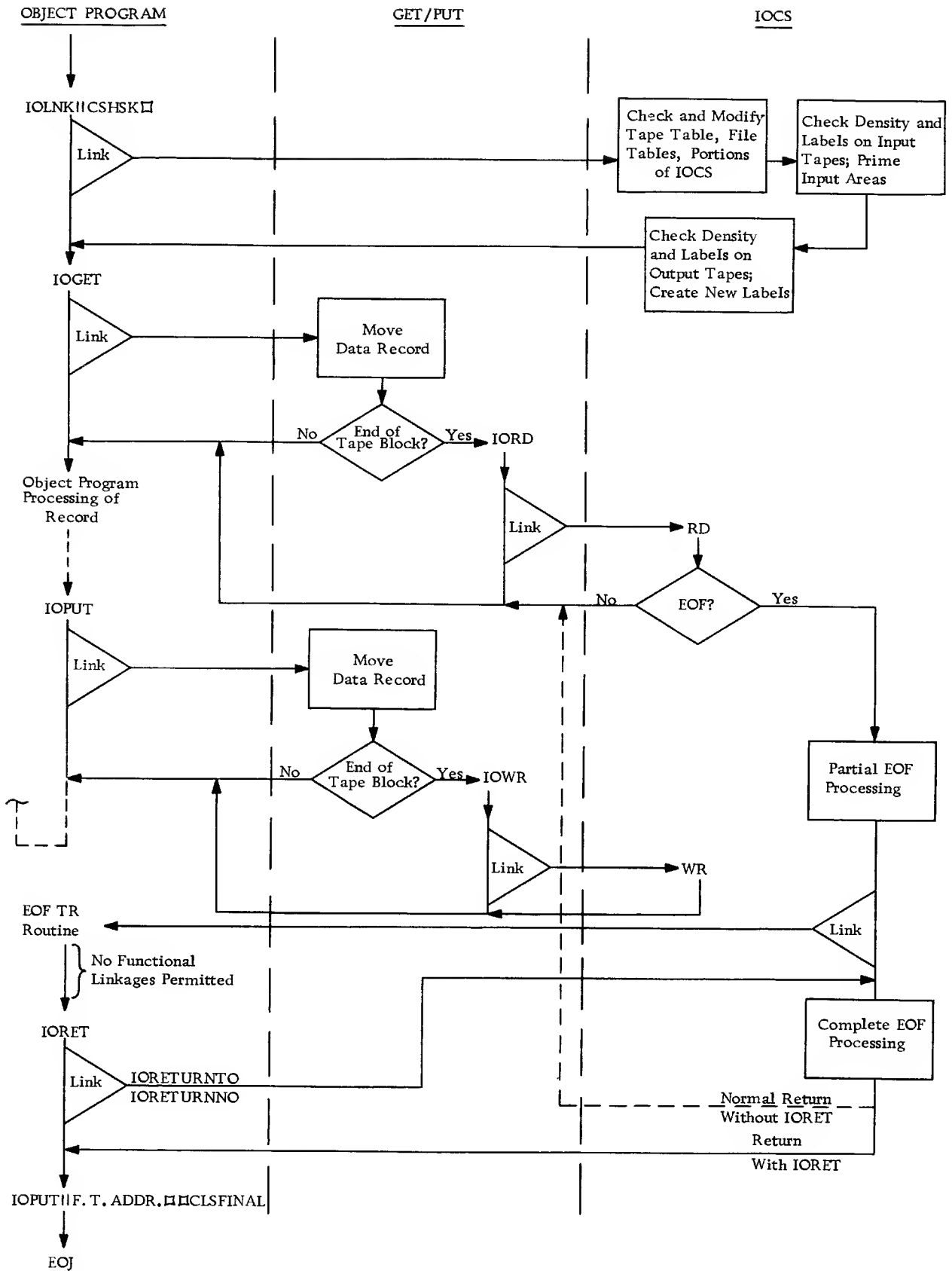
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Figure 1. This flow chart illustrates a typical program using the preassembled IOCS, and indicates the relationship between the object program, the Get/Put System, and the end-of-file routines. Certain routines are omitted, and the routines shown are not all in the exact sequence.

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instruction. This macro functions in the same manner as the IOGET
macro, keeping track of blocked records, and issuing write requests
when required. (In the case of unblocked records, write requests
are issued each time the macro is executed; in the case of blocked
records, a write request is issued only when the movement of a
record from the work area causes the output area to be filled.)

When the processed record has been moved out of the work area,
control is returned to the object program, which may then request
a new data record (IOGET).

The flow of data and processing may continue in this fashion (IOGET,
process, IOPUT) until an end of file is reached. (Tape records are
read and written automatically by the Get/Put System.)

When an end-of-file condition is reached, IOCS will transfer to the
End-of-File Transfer Address specified in the associated file table.
The object program routine which starts at the EOF Transfer
Address must be terminated by a return to IOCS at entry points
tagged IORETURNTO or IORETURNNO, and must not include any
functional linkage to IOCS.

The subsequent return to the object program from IOCS is normally
just beyond the linkage to IOCS which caused the end of file (IOGET).

Should the object programmer wish a return from IOCS at some other
point, he will find the IORET macro-instruction useful. IORET is
coded at the end of the object program routine which starts at the
EOF Transfer Address, and takes care of the necessary return to
IOCS at IORETURNTO or IORETURNNO. In addition, however, it
will modify IOCS so that the subsequent return to the object program
from IOCS will be just beyond the IORET macro rather than just
beyond the IOGET which caused the end of file.

Functional linkages to IOCS may be made beyond the IORET macro.
When end of file constitutes end of job, the object program may close
the output files through the macro-instruction IOPUT with a third
operand of CLSFINAL.

If the object program requirements of data movement fit into the pattern
described above, the object programmer need know little more about
IOCS than has been mentioned. Some additional knowledge will be re-
quired in the handling of labels, particularly if nonstandard labels are used.

In the approach presented, IOCS will fully utilize the buffering capabilities
of the 7080. If the Get/Put System of data movement is not used, a more
complete knowledge of IOCS will be required.

A Checklist for the Use of IOCS

There are a number of basic requirements which the programmer must meet before he is able to make use of the preassembled IOCS. Consideration must be given to these requirements at three points:

1. At coding time

2. At assembly time

3. At object time

This portion of the manual is concerned primarily with providing the programmer with a convenient check list to which he may refer at these various points. The specific requirements are merely referenced, and no details are provided here regarding how to fulfill these requirements. Details are provided elsewhere in this manual.

At Coding Time

1. Specify 7080 IOCS: The first IO macro-instruction used in the object program must be the macro-instruction IOCS.

2. Set up Tape Table: This table may be set up by means of the IOTA and IOTS macro-instructions at any point in the object program following the IOCS macro-instruction. It must begin at actual location 000500.

3. Set up File Tables: These tables may be set up by means of the IOFTA, IOFTB and IOFTC macro-instructions at any point in the object program following the IOCS macro-instruction. They may be located anywhere in memory above the Tape Table, except in IOCS (000500-025000) and the last 2000 positions of memory.

4. Enter Eighty and Interrupt Mode: No functional linkage to IOCS should be made unless the 7080 is in 7080 and interrupt mode. The object program must not leave interrupt mode.

5. Execute Housekeeping: IOCS housekeeping must be executed before any other functional linkage is made to IOCS, i.e., IOLNK to CSHSK must be the first functional linkage made to IOCS. (1)

6. Check Record Format: If Get/Put or Record Length Checking is used by the object program, records must be defined in accordance with tape format specifications. Maximum tape record size is 9995.

7. Code Specialized Routines: Any special operations the user wishes to perform at beginning or end of reel, beginning or end of file, etc. must be coded at the appropriate IOCS transfer address or exit point. These routines must terminate with a return to IOCS at IORETURNTO or IORETURNNO (or, in certain cases, IOTRSEXIT).

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(1) The user may, under certain conditions, use the IOTYP or IODEC macro before linking to IOCS housekeeping.

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8.   Code IOCS Macro-Instructions: Any channel tape operations must be accomplished when required by the object programmer through IOCS macro-instructions which generate the necessary functional linkages to IOCS. These macros must not be coded within specialized routines.

9.   Programming Considerations: Check the list of Important Programming Considerations at the beginning of this manual.

At Assembly Time

1.   Create System Tape: A librarian run on the 7058 Processor system tape must be performed with the 7080 IOCS library material as input.

2.   Assemble Object Program: The system tape (as created above) must be used to assemble an object program for use with the 7080 IOCS.

At Object Time

1.   Loading Sequence: The assembled object program may be combined with the preassembled IOCS and readied for loading as follows:

     a.   The loading program

     b.   Preassembled IOCS

     c.   Object program

     d.   "00" card

Should the user wish to load IOCS and the object program separately, he may do so by placing a "00" card after IOCS in addition to the "00" card following the object program. However, IOCS must still be loaded prior to the object program. If desired, IOCS may be left in memory from one program to the next.

2.   Prepare Control Cards: If any tapes contain standard headers, control cards must be prepared by the user and loaded in the card reader or on the tape specified by an IOTS macro-instruction.

IOCS80 TAPE TABLE

Introduction

The Tape Table defines the function of every tape unit attached to each channel used by the object program. The table consists of two sections.

The first section is the main section, and is 200 positions in length, providing for forty 5-character entries. Each entry refers to a specific tape unit, and specifies whether the unit contains a base tape, an alternate tape, or an unassigned tape. The base tape entry, in addition, specifies the memory address of a file table. (The file table contains all necessary information about the associated file, and is described in detail in another section of this manual, "IOCS80 File Tables.")

The second section of the Tape Table is the special tape section. This section is 25 positions in length, and provides for five 5-character entries. Each entry refers to a special function which may or may not be required by the object program. The entry specifies whether or not a tape has been assigned to perform the special function.

The Tape Table may be set up by means of the macro-instructions IOTA and IOTS, described elsewhere in this manual.

The Tape Table makes it possible to completely change (include, exclude or modify) the use of a tape unit without modifying a single instruction in the object program. The Tape Table also makes it easy to decrease the number of channels used by a program.

Tape Table Details

Location and Length

The main section of the Tape Table is located in memory positions 000500-000699. A five-character terminating field is defined by IOCS in memory positions 000700-000704. When less than 40 tapes are used, a terminating field must also follow the last significant tape entry. The tape entries for a file are arranged with the base tape entry first, followed immediately by all associated alternate tape entries, placed in the sequence in which they are to be used.

The special tape section of the Tape Table is located in memory positions 000705-000729, and is followed by a five-character terminating field. Five entries must be defined with either a base tape entry or an unassigned entry. A base tape entry is specified when a tape has been assigned for a special function; an unassigned entry is specified when no tape has been assigned for a special function. The special functions and the memory location of their associated tape entries are shown in Figure 2. Detailed information on the various functions (checkpoint, dumping, control cards) may be found elsewhere in this manual.

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SPECIAL FUNCTION TAPE	MEMORY LOCATION FOR TAPE ENTRY
(1) Checkpoint Output Tape	000705-000709
(2) Checkpoint Work Tape	000710-000714
(3) Dump Tape (for recording error records)	000715-000719
(4) Message Output Tape	000720-000724
(5) Control Card Tape (for reading Standard Header control cards)	000725-000729

Figure 2. Special Functions Defined in Special Tape Section.

If no tapes are to be used for any of the functions specified in Figure 2, no entries need be prepared for this section. IOCS will then define all entries in this section as unassigned.

In addition, one base tape entry may be specified for several functions. For example, referring to Figure 2, the same entry may be specified for (2), (3), (4), and (5). A base tape entry in the main section of the Tape Table can also be specified in the special tape section, such as when checkpoint records are to be written at the beginning of each reel of an output file. However, when more than one entry specifies the same file table, the associated select address for each entry must also be the same.

Figure 3 shows the Tape Table as defined in memory by IOCS80.
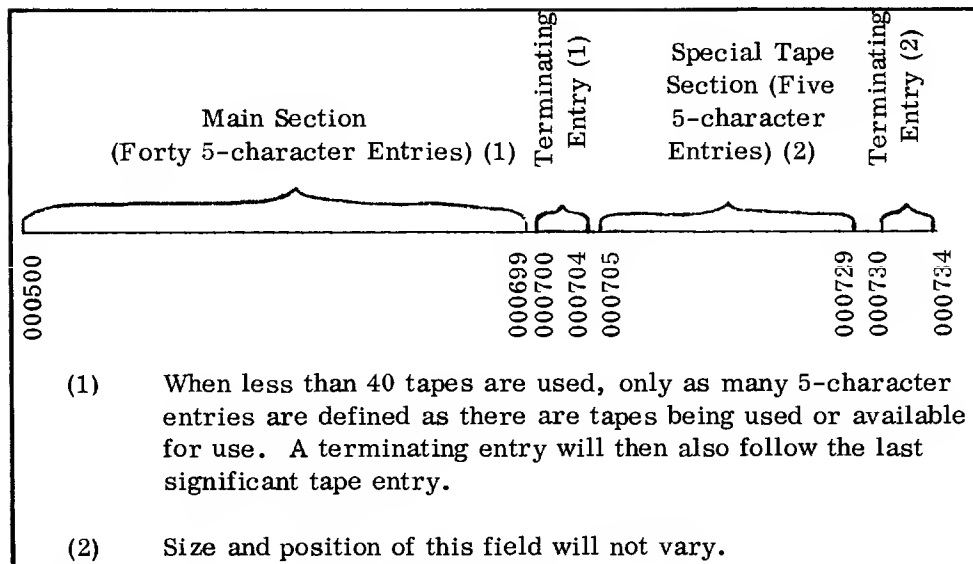
Figure 3. Structure of IOCS80 Tape Table.

(1)   When less than 40 tapes are used, only as many 5-character entries are defined as there are tapes being used or available for use. A terminating entry will then also follow the last significant tape entry.

(2)   Size and position of this field will not vary.

BASE TAPE ENTRY

A base tape entry is placed in the main section of the Tape Table for each tape unit on which the first reel of a file is mounted, and in the special tape section if tapes on the file have been assigned a special function. Each base tape entry must refer to a file table containing the information to be used by the base tape unit and any associated alternate tape units. The base tape entry generated is composed as follows (see macro-instructions IOTA, IOTS):

Position 1: The tape number (0-9; never zoned)

Positions 2-5: The four-character high-speed transmit address of the file table + 100. In addition, position 4 will include the following zoning to designate the channel number:

00   Channel 0
01   Channel 1
10 (-) Channel 2
11 (+) Channel 3

Example: If the high-speed transmit address of the file table for base tape 2209 is 029904, the following entry will be generated:

$$9\overset{+}{0}0\overset{-}{0}4$$

ALTERNATE TAPE ENTRY

If a file consists of several reels of tape, some of which are to be mounted on tape units other than the base tape unit, the additional units are known as alternates. Up to four alternates may be associated with a base tape. The alternate tape entries must immediately follow the base tape entry in the main section of the Tape Table, and must be placed in the order of their use. (An alternate entry is never valid in the special tape section of the Tape Table.) Each alternate entry specifies the tape select address, and may be assigned on any channel. However, alternates should be assigned on the same channel wherever possible.

The alternate tape entry generated is composed as follows (see macro-instruction IOTA):

Position 1: A blank (b) to indicate alternate entry

Positions 2-5: The tape select address

Example: The following entry will be generated for alternate tape 2106:

b2106

UNASSIGNED TAPE ENTRY

There are two types of unassigned tape entries. One type is specified in the main section of the Tape Table, and indicates a particular tape unit is not used by the object program, but is available for use (free tape). The second type is specified in the special tape section of the Tape Table, and indicates that no tape has been assigned to perform a specific function in the object program.

The first position of an unassigned tape entry is a minus (-) sign. To designate a free tape in the main section of the Tape Table, IOCS will generate the tape select address in positions 2-5. To designate no tape assigned to a special function in the special tape section, IOCS will generate four blanks (bbbb) in positions 2-5. (1) (See macro-instructions IOTA, IOTS.)

<u>Examples</u>:   To designate tape 2104 as a free tape, the following entry will be generated in the main section of the Tape Table:

-2104

To designate no tape assigned for the message output function, the following entry will be generated in the special tape section (memory positions 000720-000724):

-bbbb

TERMINATING ENTRY

Terminating entries must always appear in memory positions 000700-000704, and 000730-000734, following the main section and special tape section, respectively, of the Tape Table. If less than 40 tapes are used, a terminating entry must also follow the last significant tape entry in the main section.

Terminating entries are defined by IOCS as follows:

Memory Positions	000700-000704:	Abbb$\bar{+}$
Memory Positions	000730-000734:	Abbb$\bar{+}$
After Last Significant Tape Entry in Main Section (Less than 40 Tapes used):		$\overset{+}{0}$bbb$\bar{+}$

Figure 4 shows the Tape Table as defined by IOCS80 for the following sample tape configuration:

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(1)   An exception occurs in the case of no tape assigned to the error dump function (positions 000715-000719), in which case -000$\overset{+}{0}$ will be generated as a counter for the number of records dumped on the typewriter. In case no tape is assigned as the checkpoint work tape, the number of the octant to be used will be generated in position 000714.

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FILE	TAPES	FILE TABLE ADDRESS
Master Input	2104-2106	25004
Transaction Input	2000-2001	25204
Reference Tables (Input)	2100	25404
Master Output	2101-2103	25604
Transaction Listing (Output)	2004	25804
Error Dump & Checkpoint Work	2005	26004
Checkpoint Records	2101-2103	25604
Free Tapes	2002, 2006-2008	

Address	Type of Entry	Contents
000500	Type of Entry	
000505	Base	45004 (01)
000510	Alt.	b2105
000515	Alt.	b2106
000520	Base	05204 (00)
000525	Alt.	b2001
000530	Base	05404 (01)
000535	Base	15604 (01)
000540	Alt.	b2102
000545	Alt.	b2103
000550	Base	45804 (00)
000555	Base	56004 (00)
000560	Free	-2002
000565	Free	-2006
000570	Free	-2007
000575	Free	-2008
000580	Terminating	+0bbb‡
bbbb		
000700		
000705	Terminating	Abbb‡
000710	Base	15604 (01)
000715	Base	56004 (00)
000720	Base	56004 (00)
000725	Unassigned	-bbbb
000730	Unassigned	-bbbb
000734	Terminating	Abbb‡

Figure 4. Sample IOCS80 Tape Table Entries.

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IOCS80 FILE TABLES

Introduction

File tables contain descriptions of specific tape files to be handled by IOCS. When using single-reel files and multireel files, one file table is required for each file. When using a multifile reel, all files on the reel should be described by one file table. However, the user must provide any necessary or desired programming to alter the file table information from file to file.

A file is related to a physical tape unit (or units) by placing the address of its file table in a Tape Table base tape entry. The base tape entry also specifies the tape select address.

The file tables may be defined through the macro-instructions IOFTA, IOFTB and IOFTC, described elsewhere in this manual. These macro-instructions must always follow one another consecutively.

The following features of the file tables help make IOCS80 a fast, flexible system:

1. Tables are moved to a work area to avoid time-consuming modification of IOCS instructions.

2. Information in the file tables is divided into two types:

   a. That which is required only at beginning and end of reel and beginning and end of file.
   b. That which is required each time an input/output operation is executed.

File Table Details

Composition

A file table consists of two sections. Section I is unconditionally 95 characters in length, and contains information for use at beginning and end of reel and beginning and end of file. Section II is variable in length (minimum, 35 characters) and contains information required each time an input/output operation is executed. The high-speed transmit address of Section II + 5 is the file table address, and is specified as the base tape entry.

The file tables may be located anywhere in memory above the Tape Table (except in IOCS and the last 2000 positions of memory), and need not be grouped together.

In the following description of file table fields, the memory positions each field will occupy in the file table work area (000800-000919) follows the field designation (FT number) and name. The associated tag (if reference is provided in the IOCS80 Linkage Points and Work Areas) will be specified following the memory positions. The file table work area is tagged CSF0000.

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SECTION I

FT-101: CSDTS Address for Read/Write Routine (000800-000804)

IOFTA unconditionally generates 10000 for this field.

CSHSK initializes the address portion of this field with the appropriate CSDTS address based on the channel on which the file is contained and type of open operation specified by the file table (FT-3013). It is also altered when the file is closed, so that a subsequent re-open may be successfully performed.

FT-1024: Total Number of Alternate Tape Units (000805)

See IOFTA operand X7.

This field is an unsigned number ranging from 0 to 4. It specifies the total number of alternate tapes used by the file (i.e., those tapes used in addition to the base tape).

The number may be altered by CSHSK to specify the actual number of alternate tape entries which follow the associated base tape entry in the Tape Table (the number will never be greater than 4).

FT-1022: Current Select Address (000806-000807)

IOFTA unconditionally generates bb for this field.

CSHSK initializes this field to specify the hundreds and units position of the select address for the base tape specified in the Tape Table. When an end-of-reel condition occurs and alternate tapes are specified, the address of the next tape to be used (FT-102) is placed in this field.

FT-102: First Alternate Select Address (000808-000809)

IOFTA unconditionally generates bb for this field.

If one or more alternate tapes are specified in the Tape Table, CSHSK initializes this field to specify the hundreds and units position of the select address for the first alternate tape. When an end-of-reel condition occurs, FT-1022 (if one alternate is specified) or FT-1033 (if more than one alternate is specified) is placed in this field.

FT-1033: Second Alternate Select Address (000810-000811)

IOFTA unconditionally generates bb for this field.

If two or more alternates are specified in the Tape Table, CSHSK initializes this field to specify the hundreds and units position of the select address for the second alternate tape. When an end-of-reel condition occurs, FT-1022 (if two alternates are specified) or FT-1031 (if more than two alternates are specified) is placed in this field.

FT-1031: Third Alternate Select Address (000812-000813)

IOFTA unconditionally generates bb for this field.

If three or more alternates are specified in the Tape Table, CSHSK initializes this field to specify the hundreds and units position of the select address for the third alternate tape. When an end-of-reel condition occurs, FT-1022 (if three alternates are specified) or FT-3014 (if four alternates are specified) is placed in this field.

FT-3014: Fourth Alternate Select Address (000814-000815)

IOFTA unconditionally generates bb for this field.

If four alternates are specified in the Tape Table, CSHSK initializes this field to specify the hundreds and units position of the select address for the fourth alternate tape. When an end-of-reel condition occurs, FT-1022 is placed in this field.

FT-3013: Open Type Indicator (000816)

See IOFTA operand X19.

This field specifies whether or not the base tape of the file is to be opened immediately in CSHSK. If the open operation is to be delayed until the object program first links to IOCS for an input/output operation on this file, the base tape need not be in Ready status in CSHSK. One of the following codes is generated by IOFTA:

$$b \quad \text{Immediate Open}$$
$$S \quad \text{Delay Open}$$

The bit structure of the Open Type Indicator is as follows:

2 bit ON	Immediate Open
OFF	Delay Open

The remaining bits of this character are used by CSHSK.

FT-3022: Data Tape Record Counter (000817-000822), CSF0003022

IOFTA unconditionally generates $00000\overset{+}{0}$ for this field.

CSHSK initializes this field at $00000\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

This counter is increased by one each time a data tape record is read. forward spaced, or written. The counter is decreased by one each time a data tape record is backspaced.

The counter is reset to $00000\overset{+}{0}$ when an end-of-reel or intermediate or final end-of-file condition is encountered, or when a delay open or re-open operation is performed.

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FT-302: Noise/Skip Counter (000823-000824), CSF 000302

IOFTA unconditionally generates $0\overset{+}{0}$ for this field.

CSHSK initializes this field at $0\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

For input files, this counter is increased by one each time a noise record is encountered in attempting to read a data tape record. For output files, this counter is increased by one each time a Skip operation is executed in attempting to write a data tape record.

The counter is reset at $0\overset{+}{0}$ at each end-of-reel and final end-of-file condition.

FT-3032: File Count per Reel (000825-000827), CSF 0003032

IOFTA unconditionally generates $00\overset{+}{0}$ for this field.

CSHSK initializes this field at $00\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

The counter is increased by one each time a file on the tape is opened.

The counter is reset to $00\overset{+}{0}$ at each end-of-reel or final end-of-file condition.

FT-303: Error Correction Entry Counter (000828-000829), CSF 000303

IOFTA unconditionally generates $0\overset{+}{0}$ for this field.

CSHSK initializes this field at $0\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

The counter is increased by one each time an entry is made to the error correction routine.

The counter is reset to $0\overset{+}{0}$ at each end-of-reel or final end-of-file condition.

FT-3043: Permanent Error Counter (000830-000831), CSF0003043

IOFTA unconditionally generates $0\overset{+}{0}$ for this field.

CSHSK initializes this field at $0\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

For input files, this counter is increased by one each time a record is accepted with redundancies replaced by IOCS or the console operator, and processing is continued; or when the dump record option is selected. For output files, the counter is increased by one each time a record is accepted when a PCT persists (no redundancies are present in memory), and processing is continued.

The counter is reset to 0$\overset{+}{0}$ at each end-of-reel or final end-of-file condition.

FT-304: Last Noise Record Counter (000832-000834), CSF 000304

IOFTA unconditionally generates 00$\overset{+}{0}$ for this field.

CSHSK initializes this field at 00$\overset{+}{0}$ unless FT-5064 specifies the base tape is not to be rewound.

Each time a noise record is encountered, this field is altered to specify the three low-order positions of the record counter for the file.

The counter is reset to 00$\overset{+}{0}$ when an end-of-reel or intermediate or final end-of-file condition is encountered, or when a delay open or re-open operation is performed.

FT-4014: Label Indicator (000835), CSF 0004014

See IOFTA operands X10, X11, and X12.

This field specifies the type of labels used for the file. Codes are generated by IOFTA as follows:

LABEL TYPE	CODE
Standard Header and Standard Trailer	X
Standard Header and Special Standard Trailer	T
Standard Header and Nonstandard Trailer	V
Standard Header and No Trailer	/
Nonstandard Header followed by Tape Mark and Standard Trailer	G
Nonstandard Header followed by Tape Mark and Special Standard Trailer	C
Nonstandard Header followed by Tape Mark and Nonstandard Trailer	E
Nonstandard Header followed by Tape Mark and No Trailer	A
Nonstandard Header not followed by Tape Mark and Standard Trailer	F
Nonstandard Header not followed by Tape Mark and Special Standard Trailer	B
Nonstandard Header not followed by Tape Mark and Nonstandard Trailer	D
Nonstandard Header not followed by Tape Mark and No Trailer	+
No Header and Standard Trailer	O
No Header and Special Standard Trailer	K
No Header and Nonstandard Trailer	M
No Header and No Trailer	—

The bit structure of the Label Indicator is as follows: (1)

1 bit ON   A tape mark does not follow a header.
       OFF   A tape mark follows a header.

2 bit ON   A standard trailer is not used.
       OFF   A standard trailer is used.

4 bit ON   No trailer is used.
       OFF   A trailer is used.

A bit ON   No header is used.
       OFF   A header is used.

B bit ON   A standard header is used.
       OFF   A standard header is not used.

FT-401: Header Transfer Address (000836-000839), CSF 000401

See IOFTA operand X3.

This field contains the address of the first instruction of the user's specialized beginning-of-reel and beginning-of-intermediate-file routine. If there is no routine specified, IOFTA will generate the address IORETURNTO. A transfer will be made to this address in any of the following cases:

1.   During execution of CSHSK for the first reel of the file, or during execution of a delay open operation.
2.   At the beginning of each alternate reel of the file.
3.   During execution of an IOMFO (Multifile Open) operation.
4.   On a multifile input tape, when either
     a.   an intermediate standard header has been encountered following a tape mark, or
     b.   a tape mark has been encountered and standard headers are not used, and the specialized end-of-reel routine has determined that the condition existing is not end of reel.

FT-4024: Checkpoint Indicator (000840), CSF 0004024

See IOFTA operands X9 and X17.

This field specifies whether or not the file is connected in any way with checkpoint. A minus (-) in this field indicates this file has no connection with checkpoint. If the file is connected in any way with checkpoint, this field also specifies one or more of the following:

---

(1) 4 bit ON and 2 bit OFF indicate Special Standard Trailer.

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1. Tapes of an input file contain checkpoint records.
2. If a checkpoint should be taken when an end-of-reel condition occurs for the file.
3. If a checkpoint should be taken when an intermediate or final end-of-file condition occurs for this file.

Codes generated by IOFTA are as follows:

INPUT FILES	CODE	VALID, Separate Ckpt. O/P	VALID, Ckpt. Each O/P Reel
(1) Contains checkpoint records at beginning of each reel	A	X	X
(2) Take a checkpoint at end of reel	B	X	
(3) Take a checkpoint at intermediate or final end of file	D	X	
(4) Combination of (1) and (2)	C	X	
(5) Combination of (1) and (3)	E	X	
(6) Combination of (2) and (3)	F	X	
(7) Combination of (1), (2) and (3)	G	X	
(8) No connection with checkpoint	-	X	X
OUTPUT FILES			
(1) Take a checkpoint at end of reel	B	X	X
(2) Take a checkpoint at intermediate or final end of file	D	X	
(3) Combination of (2) and (3)	F	X	
(4) No connection with checkpoint	-	X	X

If this file table has been specified by the checkpoint output tape entry in the special tape section of the Tape Table, CSHSK will alter the code to one of the following:

Separate Checkpoint Output Tape   A
Checkpoint Output at Beginning of
        Each Reel   C

The bit structure of the Checkpoint Indicator is as follows:

1 bit ON   This file does not contain checkpoint records.
      OFF If input, checkpoint records (followed by a tape mark) precede the first data tape record on each reel of this file. If output, checkpoint records will be written on tapes of this file.

2 bit ON   Do not take a checkpoint at an end-of-reel condition for this file.
      OFF Take a checkpoint at an end-of-reel condition for this file.

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4 bit ON Do not take a checkpoint at an end-of-file con-
dition for this file.

OFF Take a checkpoint at an intermediate or final
end-of-file condition for this file.

A bit ON This file has no connection with checkpoint.

OFF This file has a checkpoint function (as specified
by the 1, 2 and 4 bits).

FT-402: End-of-Reel Transfer Address (000841-000844), CSF000402

See IOFTA operand X4.

This field contains the address of the first instruction of the user's
specialized end-of-reel routine. If there is no routine specified, IOFTA
will generate the address IORETURNTO. (If a nonstandard trailer or no
trailer is used on an input tape, and the end of a tape reel is to be accepted
as an end-of-file condition without any specialized routine, IORETURNNO
may be specified for this field.)

A transfer is made to this address under any of the following conditions:

1. A tape mark has been encountered and
    a. a standard end-of-reel trailer has been encountered
        on an input tape; or
    b. special standard trailers are specified; or
    c. standard trailers are not used.

2. A reflective spot is sensed on an output tape.

3. An IOFER (Force Output End of Reel) operation has been issued.

FT-4034: File Type Code (000845), CSF0004034

See IOFTA operands X8, X15, and X16.

This field specifies whether the file is on single file or multifile tape(s);
whether the file is handled sequentially or nonsequentially; whether or not
a tape is to be unloaded after rewinding at an end-of-reel or final end-of-
file condition; and whether an end-of-reel condition is to be handled in
Mode 1 or Mode 2. Codes are generated by IOFTA as follows:

TYPE OF FILE	MODE 1		MODE 2	
	RWD	RWD-UNL	RWD	RWD-UNL
SINGLE FILE				
Sequentially handled	C	G	L	P
Nonsequentially handled	A	E	J	N
MULTIFILE				
Sequentially handled	B	F	K	O
Nonsequentially handled	+	D	-	M

Specification of sequential or nonsequential handling determines the positioning of the tape when an intermediate or final end-of-file condition occurs on an input tape.

1. Sequential Handling: When a final end-of-file condition occurs on a single or multifile input tape, the tape will be rewound. When an intermediate end-of-file condition occurs on a multifile tape, the next file will be opened.

2. Nonsequential Handling: When a final end-of-file condition occurs on a single or multifile input tape, or when an intermediate end-of-file condition occurs on a multifile tape, the tape is positioned immediately preceding the tape mark which caused the end-of-file condition.

Specification of Mode 1 or Mode 2 determines when a transfer will be made to the object program. (See CSEOF section of this manual.)

The bit structure of the File Type Code is as follows:

1 bit ON The file is on multifile tapes.
     OFF The file is on single-file tapes.

2 bit ON Tapes of an input file are to be handled nonsequentially at an intermediate or final end-of-file condition.
     OFF Tapes of an input file are to be handled sequentially at an intermediate or final end-of-file condition.

4 bit ON Do not unload tapes of this file after rewinding at an end-of-reel or final end-of-file condition.
     OFF Unload tapes of this file after rewinding at an end-of-reel or final end-of-file condition.

A bit ON Tapes of this file are to be handled in Mode 2 at an end-of-reel condition.
     OFF Tapes of this file are to be handled in Mode 1 at an end-of-reel condition.

FT-403: End-of-File Transfer Address (000846-000849), CSF 000403

See IOFTA operand X5.

This field contains the address of the first instruction of the user's specialized final end-of-file routine. If there is no routine specified, IOFTA will generate the address IORETURNTO.

A transfer will be made to this address if any of the following conditions occur:

1. A standard end-of-file trailer has been encountered on an input tape.

2. When special standard trailers are used, or when standard trailers are not used on an input tape, and the end-of-reel or header routine (for intermediate end-of-file) has determined that a final end-of-file condition exists.

3. An IOCLS (Close a Tape File) operation has been issued for an output tape.

4. An IOMFC (Multifile Close) has been issued for an output tape.

In addition, CSEOF uses the A bit over the tens position of this address.

FT-5011: Current Tape Serial Number (000850-000853), CSF0005011

IOFTA unconditionally generates 0000 for this field.

If standard headers are specified for the file, the field specifies (during processing) the tape serial number of the reel currently being processed. Each time a standard header is read at beginning of reel, the tape serial number in the header is saved here.

(000854)

IOFTA unconditionally generates a slash (/) as a field separator between FT-5011 and FT-5021.

FT-5021: File Serial Number (000855-000858), CSF0005021

IOFTA unconditionally generates 0000 for this field.

If standard headers are specified for the file, the file serial number is identical to the tape serial number of the first reel of a file. For output, the file serial number is obtained from the tape serial number on the header label of the first output reel. This number will be used as the file serial number for each beginning-of-reel header for the file. The file serial number is reset to 0000 when a delay open operation is performed for an output tape.

Since the input data is contained on different physical tape reels each time a program is run, the appropriate input file serial number is obtained from control cards by CSHSK (or by updating of this field by the object program). It is used to check if input reels are mounted on the correct tape units.

(000859)

IOFTA unconditionally generates a dash (-) as a field separator between FT-502 and FT-5032.

FT-5032: Reel Sequence Number (000860-000862), CSF 0005032

IOFTA unconditionally generates 000 for this field.

CSHSK initializes this field to 001 unless FT-5064 specifies the base tape is not to be rewound.

The reel sequence number is increased by one at an end-of-reel condition. If standard headers are specified, this number is used to check if input tapes have been mounted in the proper sequence, and to specify the sequence in which output tapes are created. The reel sequence number is reset to 001 when a delay open operation is performed for an output tape.

(000863)

IOFTA unconditionally generates a blank (b) as a field separator between FT-5032 and FT-5051.

FT-5051: File Identification Name (000864-000873), CSF 0005051

See IOFTA operand X1

This field is any ten-character alphanumeric name desired to distinguish a file, such as "INVENTRANS" or "PAYROLLREC." In addition, the three high-order positions can be used to represent a current cycle number. In this case, the three high-order positions must be completely numeric and the name or number may be placed in the seven low-order positions, such as "001PAYROLL." If standard headers are specified for the file, this field is used to check if input reels are mounted on the correct tape units. The file identification name is written on each output header of the file. This field is also used by CSHSK to associate standard header control cards with the appropriate file table.

(000874)

IOFTA unconditionally generates a blank (b) as a field separator between FT-5051 and FT-5064.

FT-5064: Tape Type Code (000875)

See IOFTA operands X6, X13, and X14.

This field specifies whether the base tape of a file is to be rewound by CSHSK; whether input areas are to be primed at the beginning of a file and after execution of an IOPOS, IOBSP, or IOFSP; for output, the density which is to be used for creation of the file. Codes generated by IOFTA are as follows:

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HANDLING CHARACTERISTICS	LOW DENSITY	HIGH DENSITY
Rewind Base Tape, CSHSK 1. Output Tape; Input Tape — do not prime any areas 2. Input Tape, prime all input areas (1)	B, F, or $\overset{+}{0}$ +, D, or H	K, O, or $\bar{0}$ —, M, or Q
Do not Rewind Base Tape, CSHSK 1. Output Tape; Input Tape — do not prime any areas 2. Input Tape, prime all input areas (1)	C, G, or . A, E, or I	L, P, or $ J, N, or R

(1) This code can also be used for a tape which is originally output, but with subsequent use as input with desired priming.

The bit structure of the Tape Type Code is as follows:

1 bit ON   Rewind base tape during CSHSK.
     OFF Do not rewind base tape during CSHSK. (Usually used when a tape has been left in a fixed position by the previous program. The tape unit must be in Ready status during CSHSK.)

2 bit ON   Prime all input areas.
     OFF Do not prime input areas.

A bit ON   Tapes of an output file are to be created in high density.
     OFF Tapes of an output file are to be created in low density.

FT-5063: Automatic Dump Indicator (000876)

See IOFTA operand X18.

This field specifies whether or not data tape records which are determined to be permanently in error are to be automatically dumped (a dump tape must be provided), or if a waiting loop is to be executed to allow a console decision.

IOFTA will generate one of the following codes:

-     Automatically dump permanent error records.
- K   Effect waiting loop to allow console option.

The bit structure of the Automatic Dump Indicator is as follows:

2 bit ON   Automatically dump permanent error records.
      OFF   Effect waiting loop to allow console option.

In addition, the following use is made of this character:

A bit ON   No connection with message tape.
      OFF   This file table has been specified by the message output
            tape entry in the special tape section (second section) of
            the tape table. (Set by CSHSK.)

FT-506: Number of Days in Retention Cycle (000877-000879), CSF000506

See IOFTA operand X2.

This field indicates the number of calendar days following the creation day
this output file is to be saved, if standard headers are specified. If 000 is
specified in this field, the tape is considered available for use (i.e., im-
mediately erasable) as an output tape. 000 is indicated for an input file.

FT-5074: Type of Record Length (000880)

See IOFTB operand X9.

This field specifies the type of record length for both data records and
data tape records. F is specified in this field if both data records and
tape records are fixed in length; V is specified if either data records or
tape records are variable in length.

(000881)

IOFTB unconditionally generates a dash (-) as a field separator between
FT-5074 and FT-5084.

FT-5084: Data Record Length (000882-000885)

See IOFTB operand X10.

This field specifies the data record length of fixed length records; or the
maximum data record length of variable length records.

(000886)

IOF TB unconditionally generates a dash (-) as a field separator between F T-5084 and F T-5094.

FT-5094: Tape Record Format Description (000887-000890)

See IOF TB operand X11.

This field specifies whether data records are blocked or unblocked and, if blocked, the tape record length. This field will contain one of the following entries:

(a) 0000 for fixed length, unblocked data records not ending in a record mark.

(b) 0001 for fixed length, unblocked data records ending in a record mark; and for variable length, unblocked data records.

(c) The data tape record length for fixed length, blocked data records; or the maximum data tape record length for variable length, blocked data records.

FT-5092 (000892-000893)

IOF TB unconditionally generates bb for this field, unless tapes of an input file contain checkpoint records; in this case, Cb is generated.

Section I Terminating Record Mark (000894)

IOF TB automatically generates a record mark ($\ddagger$) to terminate Section I of the file table, for use in transmitting the fixed length section.

SECTION II

FT-2014: File Code (000895)

This field is included unconditionally. See IOF TB operands X2 and X3.

This field specifies the relative volume of the file, and whether tapes of this file are to be used as data tapes, work tapes (i.e., tapes which are not normally removed between programs and may often vary input/output functions), or program tapes.

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Codes generated by IOF TB are as follows:

TYPE OF FILE	CODE
Normal Data File	
Low Volume	A
.	B
.	C
.	D
.	E
.	F
.	G
.	H
High Volume	I
Work Tapes	
Low Volume	J
.	K
.	L
.	M
.	N
.	O
.	P
.	Q
High Volume	R
Program Tape	b (blank)

The bit structure of this code is as follows:

B bit ON   Tapes are to be used as program tapes.
        OFF Tapes are not to be used as program tapes.

A bit ON   Tapes are to be used as work tapes.
        OFF Tapes are not to be used as work tapes.

The 1, 2, 4, and 8 bits are used to indicate relative volume. (The highest volume file indication is 9; the lowest, 1.)

FT-201: Get/Put Address (000896-000899)

This field is included unconditionally.

If Get/Put is not to be used for this file, IOF TB will generate the following coding in this field:

ACON4   *

If Get/Put is to be used for this file, IOF TB will generate the address of the Get/Put routine for the file.

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This field is included unconditionally. See IOFTB operands X1, X9, and X12.

This field specifies whether tapes of the file are to be used as input or output; whether records are of fixed or variable length, and whether or not Get/Put routines are to be used with this file. Codes generated by IOFTB are as follows:

TYPE OF FILE	CODE	
	G/P	No G/P
Input		
Fixed Length Records	M	-
Variable Length Records	O	K
Output		
Fixed Length Records	N	J
Variable Length Records	P	L

The bit structure of the Status Code is as follows:

1 bit ON   Tapes of this file are to be used as input.
        OFF Tapes of this file are to be used as output.

2 bit ON   Data records of this file are fixed length.
        OFF Data records of this file are variable length.

4 bit ON   Get/Put is not to be used with this file.
        OFF Get/Put is to be used with this file.

A bit ON   The tape currently being processed is at load point; FT-101 has been modified to effect an open operation when the next entry is made to CSDTS for an input/output operation for this file.
        OFF FT-101 has not been modified to effect an open operation.

FT-203: Select Address (000901-000904), CSF000203 (1)

This field is included unconditionally. See IOFTB operand X4.

This field will contain the following information:

1.   The numeric portion of this field is initialized by CSHSK and will contain the current tape select address, based on the associated tape table entry. (When an end-of-reel condition occurs and alternate tapes are specified, the address of the next alternate tape to be used is placed in this field.)

(1) CSF000203 is defined as a five-position field, 000900-000904.

2.   The zoning over the tens and hundreds positions (comparable to ASU zoning) serves as a counter, called the Force Counter. This counter is initialized to the 16's complement of the number of input/output areas specified (FT-2054) when each file is opened. During processing this counter is the 16's complement of the number of input/output areas whose contents are available for use by the object program.

3.   The zoning over the units position specifies whether the Initiate or Stacking mode of CSDTS is to be used for this file, and whether or not a Forward Space or Backspace File operation for this file is in progress.

The zoning of the units position specifies the following:

B bit   ON   Use Initiate mode for this file.
        OFF Use Stacking mode for this file.

A bit   ON   No Forward Space or Backspace File operation is in progress for this file.
        OFF Forward Space or Backspace File operation is in progress for this file.

(000905)

This field is included unconditionally. IOFTB generates an N or an E in this field. N is generated if this file is in Initiate Mode (FT-203) and has a single input/output area; otherwise, E is generated. The 4 bit is also used by CSEOF and the Get/Put routines.

FT-202:   Location of Section I (000906-000909)

In this field, IOFTB will generate the four-character high-speed transmit address of Section I of the file table.

FT-204:   Transfer to Update Routine (000910-000914)

This field is included unconditionally.

In this field, IOFTB will generate a transfer instruction (000910) and the address of the routine (000911-000914) included in the file table (FT-214) which steps the tape record counter (FT-3022) and rotates the input/output areas (FT-205, FT-206).

FT-2054:   Total Number of Input/Output Areas (000915)

This field is included unconditionally. See IOFTB operand X7 and IOFTC operand X1.

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This field is an unsigned number ranging from 0 to 8 which specifies the total number of input/output areas to be used with this file.

FT-205: Next Input/Output Area (000916-000919)

This field is included unconditionally.

IOFTC generates the address of the first input/output area specified (FT-206). During processing, this field contains the four-character address of the next input/output area to be used.

Zoning over the tens position specifies the following:

B bit	ON	An area-compare check is to be performed by CSMRS.
	OFF	No area-compare check is to be performed by CSMRS.
A bit	ON	This is not the first input/output area to be used for this file.
	OFF	This is the first input/output area to be used for this file.

Zoning over the hundreds position specifies the following:

A bit	ON	Do not perform record length checking for data tape records of this file.
	OFF	Perform record length checking for data tape records of this file.

The B bit is used by IOCS for error checking.

FT-206: Input/Output Areas Used by File (Never in Work Area)

This field is not included unconditionally. If included, its length is variable (five to 40 positions). See IOFTC operands X6-X13.

If FT-2054 is zero, this field is not included. One five-position field is included for each input/output area specified (maximum of eight fields). Fields are arranged in the order of their use. The last five-position field is always identical to FT-205.

Each five-position field is composed as follows:

Position 1: The total number of input/output areas (FT-2054).

Positions 2-5: The input/output address (must end in 0 or 5). Zoning over the tens and hundreds position is as noted in FT-205.

FT-214: Update Routine (Never in Work Area)

This field is included unconditionally; its length is variable (ten-thirty positions).

If FT-2054 is zero, the following routine is generated:

ADM	07	FT-3022	Data Tape Record Counter
TR		CSD003001	Common Exit Point from Update Routine

If FT-2054 ranges from one to six, the following routine is generated:

(01)	RCV	(01–06)	FT-205	Next Input/Output Area
(02)	SND		FT-205+5	ASU zoning is 01–06 for area numbers one to six respectively.
(03)	SND	01	FT-205	
(04)	ADM	07	FT-3022	
(05)	TR		CS¤003001	

If FT-2054 is seven or eight, the following instruction is included in the routine between (02) and (03):

SND	(01–02)	FT-205+35	ASU zoning is 01 for seven areas; 02 for eight areas.

IOCS80 MACRO-INSTRUCTIONS

Introduction

This section describes, in detail, each macro-instruction used with the 7080 IOCS. In the descriptions, a working knowledge of the 7058 Processor is presumed.

The macro-instructions connected with IOCS may be divided into three broad categories: Descriptive macro-instructions, Functional Linkages and Modification macro-instructions.

Descriptive Macro-Instructions

These macro-instructions describe features of the object program to IOCS80. They are as follows:

IOCS — This macro must precede all other macro instructions in the assembly. It describes the object program as a 7080 or 705 III program.

IOFTA, IOFTB, IOFTC — These macros describe the files of the object program, and are used to generate file tables, associated Get/Put routines and I/O areas.

IOTA, IOTS — These macros describe the tape drives used by the object program, and are used to generate the Tape Table.

Functional Linkages

These macro-instructions link the object program to IOCS. They are coded where needed in the object program to perform specific functions. They will result in appropriate linkages into IOCS at object time to execute necessary input/output and other tape movement operations.

The functional linkages may be further divided into four separate groups: Data Movement macros, Tape Movement macros, Decision Point macros, and miscellaneous macros.

DATA MOVEMENT MACROS

These macros cause the movement of data within memory and between memory and tape. They are as follows:

IOGET — This macro moves a data record from an input area to a work area (deblocking), and will also issue read requests when required.

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IOPUT — This macro moves a data record from a work area to an output area (blocking), and will also issue write requests when required.

IORD — This macro is used to read a record from tape into an area specified in the file table. Record length checking will be performed, if specified in the file table.

IOWR — This macro is used to write a record on tape from an area specified in the file table. Record length checking will be performed, if specified in the file table.

IORDS — This macro is used to read a record from tape into an area specified in the macro-instruction.

IOWRS — This macro is used to write a record on tape from an area specified in the macro-instruction.

IODMP — This macro is used to write a record on tape from an address specified in the macro-instruction through to the end of the octant.

TAPE MOVEMENT MACROS

These macros, used for tape positioning purposes, cause tapes to be moved but do not cause the movement of data between tapes and memory (except through priming). They are as follows:

IOBSD — This macro is used to modify the Get or Put routines to effect a backspace of a data record.

IOPOS — This macro is used to position a tape within a file by either forward spacing or backspacing over a specified number of records.

IOFSP — This macro is used to forward space a tape one or more tape records within a file.

IOBSP — This macro is used to backspace a tape one or more tape records within a file.

IOFSF — This macro is used to forward space a multifile tape to the beginning of a file.

IOBSF — This macro is used to backspace a multifile tape to the beginning of a file.

DECISION POINT MACROS

These macro-instructions are used at points in the object program when a
decision must be made by the programmer before proceeding any further.
These decision points occur when a tape mark is encountered or is to be
written, when a reflective spot is encountered, at load point, and at the
end of a reel. The decision point macros are as follows:

IOCLS — This macro is used to terminate operations on either an
input tape or an output tape.

IOMFO — This macro is used to start operations on a new file of a
multifile output tape (other than at load point).

IOMFC — This macro is used to terminate operations on an output
file without rewinding the tape.

IOFER — This macro is used to force an end-of-reel condition re-
gardless of whether or not a reflective spot is sensed.

IORWD — This macro is used to rewind a tape.

IORUN — This macro is used to rewind and unload a tape.

MISCELLANEOUS

This group of Functional Linkage macro-instructions results in the genera-
tion of linkages into IOCS for the execution of a variety of operations.
They are as follows:

IOTYP — This macro is used to type a message without an associated
operator decision.

IODEC — This macro is used to set up a message and enter a waiting
loop anticipating the use of the manual interrupt keys 252
or 253.

IOHLD — This macro is used to insure that all input/output operations
on a particular file have been completed and checked. It is
also used (with a second operand of OPEN) to re-open an
input file which has been closed or to open an input file for
which a delayed-open option is specified.

IOLNK — This macro is used to link to specific routines within IOCS
other than CSDTS.

Modification Macro-instructions

These IOCS macro-instructions are used to modify existing specifications or conditions in IOCS or the object program. They are as follows:

IODCH — This macro is used to alter the Message Type Code of IOCS or object program messages, and/or to prespecify an option to be taken at decision messages.

IOIOF — This macro is used to turn the tape unit I/O indicator OFF.

IOION — This macro is used to turn the tape unit I/O indicator ON.

IOMIP — This macro is used to modify the file code of a file table so that it specifies input instead of output.

IOMOP — This macro is used to modify the file code of a file table so that it specifies output instead of input.

IORET — This macro is used to modify the IOCS return address so that when an object program specialized routine returns to IOCS, IOCS will later return control to the address following the specialized routine rather than to the address following the original linkage into IOCS.

NOTE: The following operations will not be executed if the tape has not been opened, or if it is at load point after having been rewound: IOCLS, IOFER, IOMFC, IOMFO, IORUN, IORWD and IOHLD without a second operand.

Detailed Description

All macro-instructions used in conjunction with IOCS80 are described in detail in the rest of this section. The macro-instructions are arranged in alphabetical order for ease of reference.

IOBSD: Backspace Data Record

FUNCTION

To provide linkage from the object program to an IOCS routine which will modify the counters of the Get or Put routine to effect the backspace of a data record.

INSTRUCTION FORMAT

TAG	OPERATION	NUM	OPERAND
T1	IOBSD		X1¤X2¤X3¤

where:

T1   is any tag or may be left blank.

X1   is the descriptive file table address. This operand must be the tag of an IOFTA macro-instruction.

X2   is either GET or PUT, specifying which routine is affected.

X3   is SAVE if the setting of the starting point counter is required by the object program.

   Operand X3 may be omitted.

IOBSD will cause the modification of the counters of the Get/Put routines to reflect a previous record so that a subsequent IOGET or IOPUT will move the previous record to the Get work area or the output area, rather than moving the currently scheduled record. Repeated IOBSD linkages may be used to effect multiple backspaces.

The following examples illustrate the use of IOBSD.

Example 1.

An input area contains six blocked records, and at the time the IOBSD macro-instruction is issued, record 5 is in the Get work area, as follows:

			Input Area				Get Work Area
1‡	2‡	3‡	4‡	5‡	6‡		5‡

a.   If the sequence IOBSD, IOGET is executed, record 5 will be placed in the work area specified by the IOGET linkage. If none is specified, the work area address given in the file table will be used.

b.   If the sequence IOBSD, IOBSD, IOBSD, IOGET is executed, record 3 will be placed in the specified work area.

Example 2.

An output area set up to receive six blocked records is partially completed, and contains four records, while the fifth record is in the Put work area, as follows:

	Output Area			Put Work Area
1‡	2‡	3‡	4‡	5‡

a.   If the sequence IOBSD, IOPUT is executed, the output area will be modified as follows:

1‡   2‡   3‡   5‡

b.   If the sequence IOBSD, IOBSD, IOBSD, IOPUT is executed, the output area will be modified as follows:

1‡   5‡

The Get/Put routines will backspace tape as required to accomplish these ends. The object programmer must exercise caution, however, to avoid backspacing data records beyond the limits of the file. That is, he should not attempt to IOBSD beyond the first data record of a file, since the results will not be consistent.

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IOBSF: Backspace File (On a Multifile Input Tape)

FUNCTION

To provide linkage from the object program to an IOCS routine which will perform a backspace file operation on a multifile input tape. IOBSF will also provide linkage to a file identification routine which can be written and included, if desired, by the user. IOBSF may not be used on a file which has alternate tapes on different channels.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	I OBSF		X1¤ X2¤ X3¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape that will be backspaced. If an actual address is used, the units digit must be 4 or 9.

X 2   is the address, either descriptive or actual, of the file identification routine, if one is included. If an actual address is used, the units digit must be 4 or 9.

If a file identification routine is not included, operand X2 must be omitted. In this case, the tape will be backspaced to the beginning of the file in which it is positioned when the IOBSF is executed and an exit made to the Header Transfer Address.

X 3   is HOLD if the operation is to be completed prior to a return to the object program. If omitted, a return will be made to the object program prior to the completion of the request. (1)

FILE IDENTIFICATION ROUTINE

The file identification routine is a specialized routine to determine (i.e., by means of a "counter" or a "header comparison") whether or not a multifile tape is positioned at a desired file. When a file identification routine is used, I OBSF functions as follows:

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(1) If operand X3 is omitted, an IOHLD linkage must be executed prior to any further IORD or IOGET requests for this file.

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The tape is backspaced to the beginning of the current file and the header label (if any) is read into the IOTRSHLBL area. A transfer is then made to the file identification routine, as specified in the second operand. The specialized routine then determines if the tape is positioned at the desired file and, according to this determination, transfers back to IOCS at either IORETURNTO or IORETURNNO.

If the tape is positioned at the desired file, the transfer must be to IORETURNTO. In this case, IOCS will adjust the necessary file table counters, fill input areas if priming is designated, and then return to the object program.

If the tape is not positioned at the desired file, the transfer must be to IORETURNNO. In this case, the IOBSF routine will position the tape at the beginning of the preceding file, read the header label (if any) of the file, and transfer again to the file identification routine to check the file. If load point is reached and the file identification routine returns to IORETURNNO, the operation is automatically converted to a Forward Space File (see IOFSF). If a file identification routine is used and end of tape may be reached, standard trailers must be used by the file.

Special Use of the File Identification Routine

To avoid the IOCS exit to the Header Transfer Address when the tape is to be backspaced to the beginning of the file in which it is positioned when the IOBSF is executed, operand X2 should specify IORETURNTO.

NOTE: Exit is made to the file identification routine under the same circumstances as with the specialized Header Transfer Address, End-of-Reel Transfer Address routines, etc. In other words, the machine will be in interrupt program, and the starting point counter will be set above 2000. The routine must not reference Bank 2, CASUs 7, 8, 10, 11, 12, or 15, and must preserve the settings of CASUs 1-6. Any IOTYP or IODEC linkages given must have 3rd or 4th operands, respectively, of INTERRUPT.

IOBSP: Backspace Tape Records

FUNCTION

To provide linkage from the object program to an IOCS routine which will backspace over a specified number of tape records.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOBSP		X1¤X2¤

where:

T1 is any tag or may be left blank.

X1 is the file table address, either descriptive or actual, of the tape that will be backspaced. If an actual address is used, the units digit must be 4 or 9.

X2 is the literal number of records to be backspaced, or the descriptive or actual address of a field containing the number. The field which specifies the number of records must appear in memory as a three-character signed field with left protection.

If only one record is to be backspaced, operand X2 may be omitted.

IOBSP is intended for compatibility with the IOCS for the 705 III. For new programs, see the macro-instruction IOPOS. IOBSP may not be used to backspace beyond the first record of a file or a reel.

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IOCLS: Close a Tape File

FUNCTION

To provide linkage from the object program to an IOCS routine which will perform close file operations. For output files, IOCLS will write a tape mark, an end-of-file trailer and another tape mark. For both input and output files, IOCLS will check the file table indicator and either rewind or rewind-unload the tape. For output files, IOCLS will take a checkpoint (if checkpoint at end-of-file is specified in the file table for the file being closed). This operation will not be executed if the tape has not been opened, or if it is at load point after having been rewound.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOCLS		X1¤

where:

T1   is any tag or may be left blank.

X1   is the file table address, either descriptive or actual, of the tape containing the file which is to be closed. If an actual address is used, the units digit must be 4 or 9.

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FUNCTION

To specify that the 7080 IOCS is to be used with the object program to be assembled, and to indicate whether the 7080 mode is maintained by the object program between functional linkages to IOCS. The IOCS macro-instruction must precede all other IOCS macro-instructions in the assembly.

In addition, simulated tag references for the preassembled 7080 IOCS common areas and linkage points will be included as a subroutine during the assembly of the object program.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOCS		X1¤

where:

T1   is any tag or may be omitted.

X1   is 705CONVERT or omitted.

If 705CONVERT, the object program does not maintain the 7080 mode between functional linkages to IOCS. In this case, instructions will be generated to enter 7080 mode before transferring to IOCS and to leave 7080 mode when returning control to the object program.

If omitted, the object program must be in 7080 mode before transferring to IOCS and control will be returned to the object program with the machine in 7080 mode.

IODCH: Change Message Type Codes

FUNCTION

To change the Message Type Code of an object program or IOCS message and/or to prespecify an option to be taken.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IODCH		X1¤X2¤X3¤

where:

T 1　　is any tag or may be left blank.

X 1　　is the tag of the IODEC or IOTYP macro-instruction to be changed, or, if the message is from IOCS, the tag of the message to be changed.

X 2　　is the Message Type Code to be put in the message specified. (See Type Subroutine description elsewhere in this manual.)

X 3　　is INTERRUPT if the starting point counter is above 2000. X3 should be omitted if the starting point counter is under 2000.

IODEC: Type, then Wait for Decision

<u>FUNCTION</u>

To provide linkage to an IOCS routine which will do the following:

1.   Type a message and enter a loop to await a decision from the console.
      The message should have an Identification Code to indicate that a
      waiting loop has been entered.

2.   Permit the operator to select one of two alternative courses of action
      by depressing Interrupt Key 252 or 253. The option selected will be
      indicated by the message "2" or "3."

A general description of how to set up messages is included in the dis-
cussion of the Type Subroutine elsewhere in this manual.

<u>INSTRUCTION FORMAT</u>

T A G	OPERATION	N U M	OPERAND
T1	IODEC		X1◻ X2◻ X3◻ X4◻

where:

T1   is any tag or may be left blank.

X1   is either the literal message or its descriptive or actual address.
      The message field must be terminated by a group mark.

X2   is the address, either descriptive or actual, of the routine which will
      be executed if Interrupt Key 253 is depressed. The routine which
      immediately follows the macro-instruction IODEC will be executed if
      Interrupt Key 252 is depressed. If an actual address is used, the
      units position must be 4 or 9.

      If omitted, the routine immediately following the macro-instruction
      IODEC will be executed regardless of which Interrupt Key (252 or
      253) is depressed.

X3   is the Message Type Code and predetermined option. X3 will be
      either A, B, C or D (the Message Type Code), followed by a blank,
      2 or 3 indicating no predetermined option, 252 or 253 option, re-
      spectively. (A complete description of the Message Type Codes and
      options is contained in the discussion of the Type Subroutine else-
      where in this manual.)

      If omitted, the message will be considered as Type A, and will be
      typed.

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X4   is INTERRUPT if the IODEC linkage is made from any of the specialized routines (end of reel, end of file, header transfer address routines, IOREDUNCHK, CSA90, IOTRSOPLBL). Otherwise, operand X4 must be omitted.

IODMP: Dump on Tape

FUNCTION

To provide linkage from the object program to an IOCS routine which will dump (WR01) on tape from an address specified by the macro-instruction. The write operation can be checked immediately if desired (Hold mode).

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IODMP		X1¤X2¤X3¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the output tape. If an actual address is used, the units digit must be 4 or 9.

X 2   is the address, either descriptive or actual, from which the record will be dumped. If an actual address is used, the units digit must be 0 or 5.

X 3   is HOLD if the write operation is to be checked immediately.

    If the write operation is not to be checked immediately, operand X3 should be omitted.

IOFER: Force Output End of Reel

FUNCTION

To provide linkage from the object program to an IOCS routine which will force an end-of-reel condition on an output tape, regardless of whether or not the reflective spot is sensed. This operation will not be executed if the tape has not been opened, or if it is at load point after having been removed.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOFER		X 1 ¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the output tape. If an actual address is used, the units digit must be 4 or 9.

IOFSF: Forward Space File (On a Multifile Input Tape)

FUNCTION

To provide linkage from the object program to an IOCS routine which will Forward Space File on a multifile input tape. IOFSF will also provide linkage to a file identification routine which can be written and included, if desired, by the user. IOFSF cannot be used on a file which has alternate tapes on different channels.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOFSF		X1□ X2□ X3□

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape that will be forward spaced. If an actual address is used, the units digit must be 4 or 9.

X 2   is the address, either descriptive or actual, of the file identification routine, if one is included. If an actual address is used, the units digit must be 4 or 9.

      If a file identification routine is not included, operand X2 must be omitted. In this case, the tape will be forward spaced to the beginning of the next file and an exit made to the Header Transfer Address.

X 3   is HOLD if the operation is to be completed prior to a return to the object program. If omitted, a return will be made to the object program prior to the completion of the request. (1)

FILE IDENTIFICATION ROUTINE

The file identification routine is a specialized routine to determine (i.e., by means of a "counter" or a "header comparison") whether or not a multifile tape is positioned at a desired file. When a file identification routine is used, IOFSF functions as follows:

The tape is forward spaced to the beginning of the next file, and the header label (if any) is read into the IOTRSHLBL area. A transfer is then made to the file identification routine, as specified in the second operand. The

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(1) If operand X3 is omitted, an IOHLD linkage <u>must</u> be executed prior to any further IORD or IOGET requests for this file.

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specialized routine then determines whether the tape is positioned at the desired file and, according to this determination, transfers back to IOCS at either IORETURNTO or IORETURNNO.

If the tape is positioned at the desired file, the transfer must be to IORETURNTO. In this case, IOCS will adjust the necessary file table counters, will fill input areas if priming is designated, and then return to the object program.

If the tape is not positioned at the desired file, the transfer must be to IORETURNNO. In this case, the IOFSF routine will position the tape at the beginning of the next file, read the header label (if any) of the file, and transfer again to the file identification routine to check the file. If a file identification routine is used and end of tape may be reached, standard trailers must be used by the file. If an end-of-file trailer is encountered, the tape will be rewound and re-searched from the beginning of the reel. If the correct file has not been found after the tape has been completely searched, loop/message 20211 will be executed. If an end-of-reel trailer is encountered, tapes will be alternated, an exit made to the Header Transfer Address, and the tape will then be forward spaced to the first intermediate header on the next reel.

SPECIAL USE OF THE FILE IDENTIFICATION ROUTINE

To avoid the IOCS exit to the Header Transfer Address when the tape is to be forward spaced to the beginning of the next file, operand X2 should specify IORETURNTO.

NOTE: Exit is made to the file identification routine under the same circumstances as with the specialized Header Transfer Address, End-of-Reel Transfer Address routines, etc. In other words, the machine will be in interrupt program, and the starting point counter will be set above 2000. The routine must not reference Bank 2, CASUs 7, 8, 10, 11, 12, or 15, and must preserve the settings of CASUs 1-6. Any IOTYP or IODEC linkages given must have 3rd or 4th operands, respectively, of INTERRUPT.

IOFSP: Forward Space Tape Records

FUNCTION

To provide linkage from the object program to an IOCS routine which will forward space over a specified number of tape records.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOFSP		X1¤X2¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape that will be forward spaced. If an actual address is used, the units digit must be 4 or 9.

X 2   is the literal number of records to be forward spaced or the descriptive or actual address of the number. The field which specifies the number of records must appear in memory as a three-character signed field with left protection.

If only one record is to be forward spaced, operand X2 may be omitted.

IOFSP is intended for compatibility with the IOCS for the 705 III. For new programs, see the macro-instruction IOPOS.

NOTE: The macro-instructions on the following pages—IOFTA, IOFTB and IOFTC—may be used in preparing the file tables. To simplify the preparation of these macro-instruction headers, a form has been prepared and is available in pad form. The form number is X22-6913.

These forms may be completed by filling in the page number and simply crossing out the choice of parameters which do not apply. These forms may then be used for key punching.

The macro-instruction IOFTB must be preceded immediately by the macro-instruction IOFTA. If operand X8 of IOFTB is AREAGIV, then IOFTB must be followed by the macro-instruction IOFTC, which names the I/O areas for the file. If operand X8 of IOFTB is GENAREA or omitted, IOFTC must not be used.

IOFTA: First Section of File Table

FUNCTION

To generate the first section of a file table.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOFTA		X1¤X2¤X3¤...X19¤

where:

T1   is the tag of the file table; must not be blank.

X1   is the file identification; must not be omitted or blank. If the first three characters are numerical, Cycle Checking will be assumed. (See CSTRS section of this manual.)

X2   is the number of days in the retention cycle, i.e., how many days or cycles this file is to be retained beyond the creation date. This field contains three unsigned numerical characters. If "000" is specified, the tape is available for use. "000" should be used for input files.

X3   is the ten-character tag of the Header Transfer Address. A transfer will be made to the routine starting at this address at the following times:

    a. During CSHSK.
    b. At the beginning of each new reel.
    c. At the beginning of each file on a multifile tape.
    d. At the end of a multifile tape if standard trailers are not used.

If no special processing is desired at these times, IORETURNTO should be specified in this operand.

X4   is the ten-character tag of the End-of-Reel Transfer Address. A transfer will be made to the routine starting at this address at the following times:

    a. If a standard trailer with an "R" in the sixth position is encountered.
    b. If a standard trailer with an "F" in the sixth position is encountered when special handling is designated (see X12).
    c. If a nonstandard trailer is encountered.

d. If a tape mark is encountered on an input tape which contains no trailer records.

e. If a reflective spot is encountered on an output tape.

If no special handling is desired at these times, IORETURNTO should be specified in this operand.

X5 is the ten-character tag of the End-of-File Transfer Address. A transfer will be made to the routine starting at this address at the following times:

a. If a standard input trailer with an "F" in the sixth position is encountered.

b. If a close request is issued specifying an output file.

c. If a specialized input EOR routine for a nonstandard trailer, special standard trailer, or no trailer file has told IOCS that an end-of-file condition exists.

d. If a multifile close request is issued, specifying an output file.

If no special handling is desired at these times, IORETURNTO should be specified in this operand.

NOTE: See the sections of this manual on the Tape Reel Control System (CSTRS), the End-of-File and End-of-Reel routines (CSEOF), and IOCS Exits to Specialized Routines, for a detailed discussion of the exit conditions regarding X3, X4 and X5.

X6 specifies the desired density for output tapes through the following specific operands:

HIb where high density is desired.

LOb where low density is desired.

X7 is the number of alternate drives desired. This operand must specify an unsigned digit (0-4).

X8 specifies end-of-reel and end-of-file handling through the following specific operands:

RWD1 – do not unload after rewinding, Mode 1 EOR handling.
RWD2 – do not unload after rewinding, Mode 2 EOR handling.
RUN1 – unload after rewinding, Mode 1 EOR handling.
RUN2 – unload after rewinding, Mode 2 EOR handling.

NOTE: See CSEOF section of this manual for a discussion of end-of-reel modes.

X9   is the checkpoint indicator, and specifies the occurrence of checkpoints through the following specific operands:

EORb   - take checkpoints at the end of each reel of this file. The checkpoints may occur on either a separate checkpoint tape or at the beginning of each reel of this file (must be an output file).

EOFb   - take checkpoints at end of file for this file. The checkpoints must occur on a separate checkpoint output tape.

BOTH   - take a checkpoint at both end of reel and at end of file for this file. The checkpoints must occur on a separate checkpoint output tape.

NONE   - this file has no relationship to the occurrence of checkpoints.

If X9 is omitted or blank, NONE will be assumed.

NOTE: See CSMRD section of this manual for a discussion of checkpoint. See also the macro-instruction IOTS.

X10   specifies the header type through the following specific operands:

STANDARD

NONSTAND   - An object program routine must create nonstandard output header labels and check nonstandard input header labels. (See CSTRS section of this manual.)

NOHEADER

If X10 is omitted or blank, STANDARD will be assumed.

X11   indicates whether or not a tape mark follows the header label. The following specific operands may be used:

TMbb   - This operand must be used if X10 is STANDARD.

NOTM   - This operand must be used if X10 is NOHEADER.

If X11 is omitted or blank, TMbb will be assumed.

X12   specifies the trailer type through the following specific operands:

STANDARD

SPECSTAND   - This file contains standard trailer labels, but an object program routine is to make end-of-reel or end-of-file determination. (See CSEOF section of this manual.)

NONSTANDb - An object program routine must create nonstandard
output trailer labels and check nonstandard input
trailer labels. (See CSEOF section of this manual.)

NOTRAILER - An object program routine must determine whether
the tape mark just encountered constitutes an end-
of-reel or an end-of-file condition. (See CSEOF
section of this manual.)

If X12 is omitted or blank, STANDARD will be assumed.

X13 indicates whether or not the tape is to be rewound during IOCS
Housekeeping through the following specific operands:

HSKRWD

NORWDb - When this operand is used, the file table and associated
file will be initialized by CSHSK except for label check-
ing and the initialization of the record, error and end-
of-reel counters. Priming will occur if indicated in the
file table. Files which contain any header labels and
are positioned at load point must be indicated as
HSKRWD files. See CSHSK section of this manual for a
further discussion of NORWD.

If X13 is omitted or blank, HSKRWD will be assumed.

X14 indicates whether or not priming is to occur on this file during CSHSK
and at the completion of certain special operations (see summary table
in CSDTS section). The following specific operands may be used:

PRIME

NOPRI - The Data Travel System assumes that priming precedes
the normal processing of an input file. If NOPRI is
indicated in X14, the object program must fulfill this
function by giving as many IORD linkages as there are I/O
areas, prior to the processing of any data from this file.

If X14 is omitted or blank, PRIME will be assumed.

X15 specifies single or multifile through the following specific operands:

SINGLE

MULTI - X12 must not be NOTRAILER.

If X15 is omitted or blank, SINGLE will be assumed.

NOTE: See CSEOF section of this manual for a discussion of multifile re-
quirements.

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X16   specifies sequential or nonsequential handling of the file through the following specific operands:

SEQUEN

NONSEQ

If X16 is omitted or blank, SEQUEN will be assumed.

NOTE: See CSEOF section of this manual for a discussion of nonsequential handling.

X17   indicates the presence or absence of checkpoint records on <u>input</u> files through the following specific operands:

CKPTRCDSb

NOCKPTRCD - This operand must be used for <u>output</u> files.

If X17 is omitted or blank, NOCKPTRCD is assumed.

NOTE: See CSMRD section of this manual concerning the use of output files for the recording of checkpoints.

X18   indicates the handling of records when permanent read or write errors occur. The following specific operands may be used:

DUMP - Tape records containing permanent redundancies will be automatically dumped. A dump tape must be specified (see macro-instruction IOTS).

NODP - Do not dump records automatically.

If X18 is omitted or blank, NODP is assumed.

NOTE: See CSERR section of this manual concerning permanent read/ write errors and the automatic dump option.

X19   specifies a delayed open through the specific operand DELAYOPEN. Housekeeping for files operating under the delayed-open option will be incomplete in that label checking or label creation and priming will not occur. The file table will be initialized in all respects, including updating of the label control information, i.e., label control cards will be required for input files.

Files operating under the delayed-open option may be opened as follows:

a. Input files - through the functional linkage IOHLD with a second operand of OPEN. (The functional linkage IORD will result in the loss of the first record if priming is specified.)

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b. Output files – through a normal output request (IOWR or IOPUT
    resulting in IOWR).

NODELAY in operand X19 specifies the file is to be opened completely
during the execution of IOCS Housekeeping. If operand X19 is omitted
or blank, NODELAY is assumed.

NOTE: A further discussion of the delayed-open option is contained in the
       CSHSK section of this manual.

IOFTB: Second Section of File Table

FUNCTION

To generate the second section of a file table.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
	IOFTB		X1¤X2¤X3¤...X16¤

where:

X1   is either IP or OP, specifying input or output, respectively.

X2   is DATA, WORK or PROG.

If DATA, the file is a normal input or output file.

If WORK, the file is a data file but is not normally removed between programs. For example, an output file which will be used subsequently as an input file, or an input file which will be used subsequently as a scratch (output) tape. Class B messages will be ignored on a work tape.

If PROG, the file table is for the program tape.

X3   is the relative file volume. The digits 1 through 9 should be used to describe the volume of this file as compared to other files in the same program. The largest volume file indication is 9, the smallest 1.

X4   is either INITb or STACK, describing the operating mode of the file. See IODTS section of this manual for a discussion of the Initiate and Stacking modes of operation.

X5   is either CKLNG or NOCHK.

If CKLNG, the length of all records read or written will be checked, except for records read or written through the IORDS, IOWRS and IODMP linkages. Record lengths may be checked for IORDS or IOWRS depending upon the parameters of the linkage. The requirements of input/output area definition for record length checking should be noted in the CSDTS section of this manual.

If NOCHK, no record length checking will occur on reading and writing (except IORDS and IOWRS as noted above).

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X 6   indicates the availability of input/output areas for the checking of the repositioning of tapes during restart operations. Tapes are repositioned during restart through the file counter and record counter. As a cross check, it is desirable to compare a portion of the last record read or written to the record in memory at the time memory was recorded. If the input area is not modified, this comparison may be made; for output files, CMPCK may always be specified. The availability of areas for this checking is indicated through the following specific operands:

CMPCK
NOCMP

X 7   specifies the number of input/output areas to be used with this file. An unsigned, single digit 0 through 8 may be used. "C" may be specified if this file is to be triple-area rotate. If this file is describing the message or dump tape file, zero areas should be specified.

X 8   indicates whether or not input/output areas are to be generated by the macro-generator (including record length checking fields) through the following specific operands:

GENAREA – Generate areas with the file table.
AREAGIV – Areas given (see IOFTC – operands X6-X13).

If operand X8 is omitted or blank, GENAREA is assumed.

X 9   indicates type of record length through the following specific operands:

F – fixed-length records.
V – variable-length records.

X 10   is a four-digit unsigned parameter which indicates the data record length for fixed-length records or the maximum data record length for variable-length records.

X 11   describes the record format through the following specific operands:

0000 – Fixed length, unblocked records not ending in a record mark. (If this operand is used for Get files, the work area must be divisible by five and at least five characters bigger than the record; if it is used for Put files, both a group mark and a record mark must be provided in the work area.)

0001 – Fixed-length, unblocked records ending in a record mark, or (if Get/Put is not used) variable-length, unblocked records.

xxxx – A four-digit, unsigned parameter indicating the tape record length for fixed-length, blocked records; the maximum tape record length for variable-length, blocked records, or (if Get/Put is used) the maximum tape record length for variable-length, unblocked records.

NOTE: Operands X12-X16 must be specified only if the Get/Put routines are used.

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X12   specifies the use of Get/Put routines with this file through the following operands:

GETb

PUTb

BOTH - Both a Get and a Put routine may be used in conjunction with a single file table by changing the file code through the macro-instructions IOMIP and IOMOP, and using the proper IOGET or IOPUT linkage.

X13   is the tag of the major work area associated with this file.

If all work areas are given in the IOGET or IOPUT linkages, the specific operand NOWORKAREA should be used.

If operand X13 is NOWORKAREA, operand X16 must be WORK or WBSD.

X14   indicates several options concerning blocking and padding through the following specific operands:

PAD9 or PADb - The last tape record of this fixed-length data record file is to be filled with 9's padding or blanks padding, respectively. It should be noted that the use of blanks padding will produce out-of-sequence data records in the final block. Files containing errors in sequence may not be used as input to MER80.

NOPA - No padding is desired for this fixed-length data record file. This option is in conflict with record length checking (IOFTB, operand X5). Some type of padding must be used with record length checking.

00xx - The maximum blocking of variable length data records may be specified as 00xx. This parameter will permit blocking for 720 Printer operations or eliminate the possibility of exceeding the maximum variable length blocking of 99 (0099).

NONE - if X14 is otherwise unused.

If this IOFTB is describing a purely Get file, operand X14 should be NONE.

X15   is DELET if this file is being prepared for 720 printer operation. In this case, the record mark of the final record in a block will be deleted. (A file with deleted record marks is not acceptable input to the Get routines.)

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is EOF9S if the Get routine is to check for 9's padding records and enter the end-of-file routine when such padding is found.

is BOTH if both of the above parameters apply.

is NONE if none of the above parameters are applicable.

X16 is BSDb if the Backspace Data Record (IOBSD) linkage is ever used with this file.

is WORK if work areas other than the work area designated by IOFTB operand X13 are ever used in the IOGET or IOPUT linkage for this file.

is WBSD if both of the above parameters apply.

is NONE if none of the above parameters are applicable.

X17 is TCT if it is desired that the Get/Put routines use the Ten Character Transmit instruction for data movement. In this case, the user must insure that the following conditions are met:

1.   All data records must be divisible by 10 and must end in a record mark.

2.   All work areas used must begin in a 0 location. (This should be done by means of a NAME entry with an A, B, or C in column 22.)

3.   If operand 8 is AREAGIV, the I/O areas defined by the subsequent IOFTC macro must begin in either:

a.   A 0 location if operand 9 is F, or
b.   A 5 location if operand 9 is V.

is omitted if the TCT method of data movement is not desired. (The 17th lozenge need not be punched.)

NOTE: The TCT method of data movement will be used even when operand 17 is omitted, if the following conditions are met:

1.   Operand 8 is GENAREA.

2.   Operand 9 is F.

3.   Operand 10 is divisible by 10.

4.   Operand 13 is the tag of a field defined by a NAME A, NAME B, or NAME C entry.

5.   Operand 16 is NONE or BSD.

6.   Operand 11 is not 0000.

IOFTC: Third Section of File Table

FUNCTION

To name the input or output areas if they are not generated through IOFTB. IOFTC is not required if the input/output areas are generated.

INSTRUCTION FORMAT

TAG	OPERATION	NUM	OPERAND
	IOFTC	X0	X1¤X2¤X3¤...X13¤

where:

X0 is the object program LASN Counter (bx). The last entry generated by IOFTC will be LASN with a blank operand on this counter. If multiple LASN counters are not used, this field may be blank.

X1 specifies the number of input/output areas to be used with this file. (See IOFTB operand X7.)

X2 is CKLNG or NOCHK. (See IOFTB operand X5.)

X3 indicates the availability of input/output areas for restart checking through the specific operands CMPCK or NOCMP. (See IOFTB operand X6.)

X4 is GP if a Get or Put routine is used with this file.

is NO if no Get or Put routine is used with this file.

X5 indicates type of record length through the following specific operands:

F - fixed-length records.
V - variable-length records.

Operands X6 - X13 are the descriptive tags of the input/output areas. Only those operands which correspond to actual input/output areas must be specified.

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IOGET: Get a Data Record

FUNCTION

To provide linkage from the object program to an IOCS routine which will move the next input data record to the specified work area. The buffered reading of a tape record will occur when an input area is depleted. IOGET can only be used with files which are in the Get/Put mode of operation.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOGET		X1¤X2¤X3¤

where:

T 1   is any tag or may be left blank.

X 1   is the descriptive file table address. This operand must be the tag of an IOFTA macro-instruction.

X 2   is the high speed transmit address of the work area to be used, either actual or descriptive. If X2 is omitted, the work area address given in the file table will be used.

X 3   is SAVE if the object program requires the setting of the starting point counter. Operand X3 may be omitted.

FUNCTION

To provide linkage from the object program to an IOCS routine which will perform a HOLD operation. All other machine operations are held up while the HOLD makes certain that the last operation on the specified file has been completed and checked for errors. If Stacking is specified for this file, all other machine operations are held up until the HOLD also clears the stacking table of all operations for this file, i.e., executes and checks those operations.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOHLD		X1¤X2¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape containing the file for which the HOLD operation is to be performed.

X 2   is EOFCK if the IOCS end-of-file routine is to be entered when a tape mark is encountered during a read operation, and the last-filled read-in area is yet to be processed.

is OPEN if the IOHLD macro is intended to open a tape file which is at load point. This operand may be used when the IOHLD macro is intended to perform a hold operation. OPEN should not be specified with an IOHLD which is intended to insure the completion of an IORD on a single-area Initiate file, an IORDS, or an IOFSF without a second operand, since such operations may result in an end of file.

If omitted, the IOCS end-of-file routine is to be entered when all areas have been processed. (This is the normal mode of operation.) A tape file which is at load point will <u>not</u> be opened by IOCS80 if X2 of the IOHLD macro is omitted.

EXAMPLE OF IOHLD WITH OPERAND X2 OF EOFCK

When, in order to properly process the last data record in a tape record, it is necessary that the next tape record be in memory (i.e., when, for sequencing purposes, the last data record of one tape record must be compared to the first data record of the next tape record), then IOHLD with the operand EOFCK should be used just prior to handling the last data record of a particular tape record.

IOHLD will make certain that the read operation pertaining to the next tape record is completed and checked before processing of the last data record is begun. The operand EOFCK will cause the IOCS end-of-file routine to be entered if a tape mark is encountered during the read operation. Since the IOCS end-of-file routine will be entered before the last data record preceding the tape mark is processed, the object program specialized end-of-file routine should provide for processing of this record. (End-of-File Transfer Address.)

NOTE: If the IOHLD request with a second operand specifies a file which had previously been closed or a file on which a delayed-open option was indicated during the execution of IOCS Housekeeping, that file will be opened (including label checking and priming, if specified in the file table). Input files operating under the delayed-open option should be opened through this use of IOHLD. The use of the IORD linkage (with a file positioned at load point) will cause the loss of the first data-tape record (if priming is specified). Output files operating under the delayed-open option may be opened with either an IOHLD or any functional linkage which would cause the writing of a data tape record. IOHLD will not perform the function described if the second operand is omitted or blank.

IOIOF: Tape Unit I/O Indicator Off

FUNCTION

To turn off the I/O Indicator of the tape unit on which the tape containing the specified file is mounted.

INSTRUCTION FORMAT

T A G	OPERATION	NUM	OPERAND
T1	IOIOF		X1◻

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the specified file. If an actual address is used, the units digit must be 4 or 9.

NOTE: This macro-instruction should not be used with the 7080 IOCS. It is included in the library only for compatibility with the 705 III IOCS.

IOION: Tape Unit I/O Indicator On

FUNCTION

To turn on the I/O Indicator of the tape unit on which the tape containing the specified file is mounted.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOION		X1⌑

where:

T1   is any tag or may be left blank.

X1   is the file table address, either descriptive or actual, of the specified file. If an actual address is used, the units digit must be 4 or 9.

NOTE: This macro-instruction should not be used with the 7080 IOCS. It is included in the library only for compatibility with the 705 III IOCS.

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IOLNK: Link to IOCS

FUNCTION

To provide linkage from the object program to each of the component IOCS routines.

Housekeeping Routine

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOLNK		CSHSK¤

where:

T 1   is any tag or may be left blank.

Checkpoint Routine

This linkage should be used only in conjunction with a separate checkpoint tape system.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOLNK		CSMRD¤

where:

T 1   is any tag or may be left blank.

Initialization Routine

This linkage is to a routine which will initialize the CASUs (clear Bank 3; set CASUs 1-6 at 1-6, respectively; set CASUs 7 and 8 to 1 and load them with 1 and 5, respectively) and reset all error triggers.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOLNK		CSINIT¤

where:

T 1   is any tag or may be left blank.

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Phase to Phase Housekeeping

This linkage is to a routine which executes all housekeeping functions except control card checking.

INSTRUCTION FORMAT

TAG	OPERATION	NUM	OPERAND
T1	IOLNK		CSPHASEHSK¤

where:

T 1   is any tag or may be left blank.

Restart Routine

This linkage is to a routine which will initiate a restart from the last checkpoint. The Restart program (CSMRS) must be available on the unit specified in the program tape entry (CSW21).

INSTRUCTION FORMAT

TAG	OPERATION	NUM	OPERAND
T1	IOLNK		CSMRS¤

where:

T 1   is any tag or may be left blank.

IOMFC: Multifile Close an Output Tape

FUNCTION

To provide linkage from the object program to an IOCS routine which will close a file on a multifile output tape. A tape mark, an end-of-file trailer and another tape mark will be written. The tape will be positioned immediately following the last data record written. If an IOMFO is subsequently issued to write another file on the tape, a tape mark, an intermediate header label (if designated), and another tape mark (if designated) will be written after the last data record, thus writing over the tape mark, end-of-file trailer and tape mark. If a subsequent file is not written, the records will be properly terminated. This operation will not be executed if the tape has not been opened, or if it is at load point after having been rewound.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOMFC		X 1 ¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the output tape containing the file to be closed. If an actual address is used, the units digit must be 4 or 9.

IOMFO: Multifile Open an Output Tape

FUNCTION

To provide linkage from the object program to an IOCS routine which will
terminate one file on a multifile output tape and position the tape to receive
records of the next file. A tape mark, an intermediate header label (if
designated) and another tape mark (if designated) will be written. This
operation will not be executed if the tape has not been opened, or if it is
at load point after having been rewound.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOMFO		X 1◘

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the out-
      put tape containing the file to be opened. If an actual address is
      used, the units digit must be 4 or 9.

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IOMIP: Change Function of Output Tape to Input

FUNCTION

To make the file code indicate that the tape is to be used as input for sub-sequent operations. (This implies that the tape had been used as output prior to this point.)

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOMIP		X1¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape to be changed from output to input. If an actual address is used, the units digit must be 4 or 9.

IOMOP: Change Function of Input Tape to Output

FUNCTION

To make the file code indicate that the tape is to be used as output for subsequent operations. (This implies that the tape has been used as input prior to this point.)

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOMOP		X 1 ¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape to be changed from input to output. If an actual address is used, the units digit must be 4 or 9.

FUNCTION

To provide linkage from the object program to an IOCS routine which will position a tape by either backspacing or forward spacing over a specified number of tape records.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOPOS		X 1 ¤ X 2 ¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the tape that will be positioned. If an actual address is used, the units digit must be 4 or 9.

X 2   is the signed literal number of records to be backspaced or forward spaced over, or the descriptive or actual address of a field containing the number. The field which specifies the number of records must appear in memory as a three-character signed field with left protection.

IOPOS is designed to replace both IOBSP and IOFSP. The IOPOS routine assumes that input areas have been primed. In using IOPOS, the programmer should assume that the tape is positioned after the last record processed, as indicated by the last IORD or IOWR linkage given. Thus, if the program has given an IORD linkage after processing record 3 and, while processing record 4 gives a linkage:

        IOPOS   FILE A ¤ #+002#¤

IOCS will position the tape before record 6 and then prime, starting with

area 1. Under the same circumstances,

        IOPOS   FILE A ¤ #-002#¤

will position the tape before record 2 and then prime, starting with area 1.

Through use of the IOPOS macro-instruction, both input and output files for an application can be properly repositioned by specifying the same counter in operand 2 of the IOPOS linkages.

IOCS will count, but will not execute, any operations which are present in the stacking table. Therefore, if an IOPOS is issued to backspace an output tape in order to read in the record just written on this tape, an IOHLD should be given to insure that the last operation (the write) has been completed and checked.

If priming is specified in the file table, IOCS will prime the input areas after having positioned the tape, i.e.; in the first example above, record 6 will be read into area 1, record 7 into area 2, etc. in the second example, record 2 will be read into area 1, record 3 into area 2, etc.

TAPE 1 2 3 4 5 6 7	

3 4	Solid arrow is assumed
Input areas before IOPOS (IORD which will cause the overlay of 3 has been made)	tape position before IOPOS. Broken arrows indicate tape position after IOPOS, but prior to priming (this
6 7	is the new assumed posi-
Input areas after IOPOS + 002 (with priming)	tion of the tape after priming.)
2 3	
Input areas after IOPOS - 002 (with priming)	

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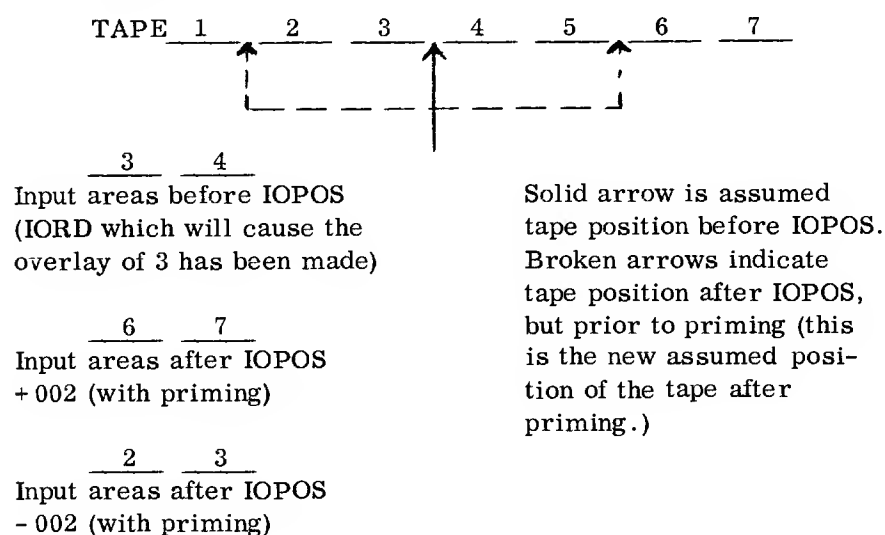
IOPUT: Put a Data Record

FUNCTION

To provide linkage from the object program to an IOCS routine which will move a data record from a specified work area to an output block. The buffered writing of a tape record will occur when a block is completed. IOPUT can only be used with files which are in the Get/Put mode of operation.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOPUT		X1¤X2¤X3¤X4¤

where:

T 1   is any tag or may be left blank.

X 1   is the descriptive file table address. This operand must be the tag of an IOFTA macro-instruction.

X 2   is the high speed transmit address of the work area from which the data is to come, either descriptive or actual. If X2 is omitted, the work area address given in the file table will be used.

X 3   is omitted, if not the final area, and is not to be written.

is CLSFINAL if this IOPUT is used to close the file after the writing of the final record (with padding, if required). When this operand is specified in an IOPUT, the IOCLS macro is no longer required to close a file.

is FINAL if this IOPUT is used to write out the last tape record (with padding, if required). This operand is suggested for use on a multifile tape, since it will not result in the tape being rewound. Otherwise, an IOCLS will still be required. To close a file on a multifile tape, IOPUT with a third operand of FINAL, followed by an IOMFO, should be used.

X 4   is SAVE if the object program requires the setting of the starting point counter. Operand X4 may be omitted.

IORD: Read Tape

FUNCTION

To provide linkage from the object program to an IOCS routine which will read records from tape. Record length checking will be included if the file table indicates this option. The read operation can be checked immediately if desired (Hold mode).

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IORD		X1¤X2¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the input tape. If an actual address is used, the units digit must be 4 or 9.

X 2   is HOLD if the read operation is to be checked immediately.

If the read operation is not to be checked immediately, operand X2 should be omitted.

NOTE: If priming is specified, IORD should not be used to open a file which is at load point due to a delayed-open option or previous functional linkage which resulted in a rewind of the tape. (See note under IOHLD.) IORD may be used to open such a file if priming is not specified.

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IORDS: Read Tape Special

FUNCTION

To provide linkage from the object program to an IOCS routine which will read records from tape into an address specified in the macro-instruction rather than in the file table. The read operation can be checked immediately if desired (Hold mode).

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IORDS		X1¤ X2¤ X3¤ X4¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the input tape. If an actual address is used, the units digit must be 4 or 9.

X 2   is the address, either descriptive or actual, into which records will be read. If an actual address is used, the units digit must be 0 or 5.

X 3   is HOLD if the read operation is to be checked immediately.

If the read operation is not to be checked immediately, operand X 3 should be omitted.

X 4   is CKLNG if record length checking is desired. If record length checking is not desired, operand X4 should be omitted.

If CKLNG is specified, the input area (operand X2) must conform to specifications for length checking, and the type of record length (fixed or variable) must be the same as that specified in the file table.

NOTE: If an IORDS specifies a file which is at load point due to a delayed-open option or a previous functional linkage which resulted in a rewind of the tape, the file will be opened (including priming) prior to the execution of the IORDS. Such files are normally opened by an IOHLD linkage.

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IORET: Change Object Program Return Point

FUNCTION

To allow an object program specialized routine (end of reel, end of file, header) to change the IOCS return address for the object program.

Normally, when object program linkages are executed for an IORD, IOWR, IOGET or IOPUT, IOCS will return control (at the completion of its functions) to the instruction immediately following the linkage. However, the specialized routine can use IORET as its last instruction to execute the required return (IORETURNTO or IORETURNNO) to IOCS. At the completion of the IOCS functions, control will be returned to the object program at the instruction following the macro-instruction IORET.

The following points should be considered when using IORET:

1. IORET is intended principally for use in the End-of-File Transfer Address on input files.
2. IORET cannot be used in the End-of-Reel Transfer Address for an output tape.
3. IORET cannot be used in the End-of-Reel Transfer Address if Mode 1 end-of-reel handling is specified in the file table.
4. IORET cannot be used on an Initiate mode file with a single input area.
5. IORET cannot be used on a file on which an IORDS without a third operand of HOLD is used, or on a file on which an IOFSF without either a second operand, or a third operand of HOLD, is used.
6. An IORET which is encountered during the execution of IOCS Housekeeping will not affect the return point to the object program, which is always after the IOLNK macro-instruction. Thus, if it is anticipated that an input file may contain no records (and Get/Put is not being used), either DELAYOPEN (operand 19 of IOFTA) or NOPRI (operand 14 of IOFTA) should be specified, or IORET should not be used.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IORET		X 1 ¤

where:

T 1   is any tag or may be left blank.

X 1   is IORETURNNO if the return to IOCS is to be at IORETURNNO.

X 1 should be omitted if the return to IOCS is to be at IORETURNTO.

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IORUN: Rewind - Unload Tape

FUNCTION

To rewind-unload a tape. A linkage is generated from the object program to an IOCS routine which will perform this operation regardless of the file table specification (of RWD or RUN). This operation will not be executed if the tape has not been opened, or if it is at load point after having been rewound.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IORUN		X 1 ¤

where:

T 1   is any tag or may be blank.

X 1   is the file table address, either descriptive or actual, of the tape to be rewound and unloaded. If an actual address is used, the units digit must be 4 or 9.

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IORWD: Rewind Tape

FUNCTION

To rewind a tape. A linkage is generated from the object program to an
IOCS routine which will perform this operation regardless of the file
table specification (of RWD or RUN). This operation will not be executed
if the tape has not been opened, or if it is at load point after having been
rewound.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IORWD		X1⌂

where:

T1   is any tag or may be left blank.

X1   is the file table address, either descriptive or actual, of the tape
      to be rewound. If an actual address is used, the units digit must
      be 4 or 9.

IOTA: Tape Table A

FUNCTION

To generate Tape Table entries as part of the current assembly. An IOTA macro-instruction must be supplied to indicate the base tape and any associated alternates for each file used in a program. In addition, the IOTA macro-instruction should be used to specify any free tapes which could be assigned functions in the program.

INSTRUCTION FORMAT

TAG	OPERATION	NUM	OPERAND
T1	IOTA		X1¤X2¤X3¤...X6¤

where:

T1   is any tag or omitted.

If IOTA is describing a base tape,

X1   is the file table address, either descriptive or actual. If an actual address is used, the units digit must be 4 or 9.

X2   is the select address of the base tape in the form 2x0y, where x is the channel number and y is the tape number within the channel.

X3-X6 are the select addresses of all the alternate tapes for this file in sequence used. If no alternates are used, X3 through X6 may be omitted.

If IOTA is describing a free tape.

X1   is FREE.

X2-X6 are the select addresses of up to five free entries in the form 2x0y, where x is the channel number and y is the tape number within the channel. If less than five free tapes are described, the latter operands may be omitted.

If IOTA is closing the Tape Table.

X1   is END.

X2-X6 should be omitted.

NOTE: The first IOTA is normally preceded by LASN @500, since the Tape Table must be located at 000500 when using the preassembled IOCS.

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IOTS: Specify Tapes with Special Functions

FUNCTION

To specify tapes which have been assigned the following functions: checkpoint output, checkpoint work, dump (for recording of error records), or secondary output for messages. This macro-instruction establishes the special tape section of the Tape Table.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
	IOTS	X0	X1¤x2¤X3¤...X10¤

where:

X 0   is the object program current LASN counter assignment. The last entry generated by IOTS will be a LASN with a blank operand on this counter. If multiple LASN counters are not used, this field should be blank.

X 1   is the file table address of the checkpoint output tape, either descriptive or actual. If an actual address is used, the units digit must be 4 or 9.

X 2   is the select address of the base tape to be used as the checkpoint output tape, in the form 2x0y, where x is the channel number and y is the tape number within the channel.

X 3   is the file table address of the checkpoint work tape, either descriptive or actual. If an actual address is used, the units digit must be 4 or 9.

X 3 may also be used to indicate the octant to be used as the checkpoint work area if no checkpoint work tape is indicated, but checkpoints are to be taken. This should be an unsigned numeric character (1-8). If this operand is omitted, the last octant will be assumed. Only the last 1,025 positions of the specified octant will be used.

X 4   is the select address of the base tape to be used as the checkpoint work tape, in the form 2x0y, where x is the channel number and y is the tape number within the channel. This operand must be omitted or blank if X3 designates a work area octant.

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X 5   is the file table address of the dump tape, either descriptive or actual. If actual, the units digit must be 4 or 9.

X 6   is the select address of the base tape which will contain dumped records, in the form 2x0y, where x is the channel number and y is the tape number within the channel.

X 7   is the file table address of the base tape which will contain the secondary output messages, either descriptive or actual. If actual, the units position must be 4 or 9.

X 8   is the select address of the base tape which will contain the secondary output messages, in the form 2x0y, where x is the channel number and y is the tape number within the channel.

X 9   is the file table address, either descriptive or actual, of the base tape which will contain the label control cards. If actual, the address must end in 4 or 9. This operand may be omitted.

X10   is the select address of the control card base tape, in the form 2x0y, where x is the channel number and y is the tape number within the channel. This operand should be omitted if X 9 is omitted.

IOTYP: Type

FUNCTION

To provide linkage to an IOCS routine which will type a message.

A general description of how to set up messages is included in the discussion of the Type Subroutine later in this manual.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOTYP		X1¤X2¤X3¤

where:

T 1   is any tag or may be left blank.

X 1   is the literal message or the left hand address of a field containing the message.

X 2   is the Message Type Code, either A, B, C or D. (A complete description of the Message Type Codes is contained in the discussion of the Type Subroutine.)

X 3   is INTERRUPT if the IOTYP linkage is made from any of the specialized routines (end of reel, end of file, Header Transfer Address routines, IOREDUNCHK, CSA90, or IOTRSOPLBL). Otherwise, operand X3 must be omitted.

IOWR: Write Tape

FUNCTION

To provide linkage from the object program to an IOCS routine which will write records on tape. Record length checking will be included if the file table indicates this option. The write operation can be checked immediately if desired (Hold mode). Write requests must never be addressed to a group mark.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T1	IOWR		X1¤X2¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the output tape. If an actual address is used, the units digit must be 4 or 9.

X 2   is HOLD if the write operation is to be checked immediately.

      If the write operation is not to be checked immediately, operand X2 should be omitted.

IOWRS: Write Tape Special

FUNCTION

To provide linkage from the object program to an IOCS routine which will write records on tape from an address specified in the macro-instruction rather than in the file table. The write operation can be checked immediately if desired (Hold mode). Write requests must never be addressed to a group mark.

INSTRUCTION FORMAT

T A G	OPERATION	N U M	OPERAND
T 1	IOWRS		X1¤X2¤X3¤X4¤

where:

T 1   is any tag or may be left blank.

X 1   is the file table address, either descriptive or actual, of the output tape. If an actual address is used, the units digit must be 4 or 9.

X 2   is the address, either descriptive or actual, from which records will be written. If an actual address is used, the units digit must be 0 or 5.

X 3   is HOLD if the write operation is to be checked immediately.

If the write operation is not to be checked immediately, operand X3 should be omitted.

X 4   is CKLNG if record length checking is desired.

If record length checking is not desired, operand X4 should be omitted.

If CKLNG is specified, the output area (operand X2) must conform to specifications for length checking, and the type of record length (fixed or variable) must be the same as that specified in the file table.

IOCS80 EXITS TO SPECIALIZED ROUTINES

Introduction

The procedures used by an installation or in a specific program may make it necessary and/or desirable for a user to supplement certain IOCS functions with specialized routines. This is particularly true in connection with beginning of file, beginning of reel, end of file, end of reel, and redundancy checking. To facilitate linkage to specialized routines at these points, the following exits are provided in IOCS:

File Table Exits

1. End-of-Reel Transfer Address

2. End-of-File Transfer Address

3. Header Transfer Address

Common Linkage Exits

1. IOTRSOPLBL (1)

2. IOREDUNCHK

3. CSA90 – Control Card Exit

IOCS always transfers to these exits in interrupt program. The starting point counter is set in Bank 3. The object programmer should use CASUs 9, 13 and 14. CASUs 1 – 6 will be set 1 – 6, respectively, CASU 7 set to 1 contains 1, and CASU 8 set to 1 contains 5. The contents of CASUs 1 – 6 are destructible, but the settings should not be destroyed. If an operation requiring the use of an accumulator is necessary, the object programmer must save the contents of Bank 0, 1, or 3 before executing this operation, and restore the contents when the operation is complete. The object program must not leave the interrupt program during the execution of specialized routines. The starting point counter must be set above 2000 on the return to IOCS.

The entry placed in the file table fields or the common linkage fields either specifies the address of a specialized routine to be transferred to by IOCS, or specifies that no specialized routine is required or desired. If a specialized routine is used, it must be terminated by a transfer back to IOCS at IORETURNTO or IORETURNNO. If a specialized routine is

_____

(1) The associated label, if any, is in the IOTRSHLBL area; the associated file table is in the CSF0000 area.

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not used, IORETURNTO or IORETURNNO must be specified in the exit field so that IOCS will continue properly. It should be noted that no linkage to IOCS can be made during the execution of a specialized routine, except for linkages to the typing and decision routines. (See macro-instructions IOTYP and IODEC.)

The following series of charts are grouped according to exit point and label type (where applicable), and describe the exit conditions, necessary specialized routine processing, and return points.

INPUT TAPE	
Exit Condition	The exit is made when a standard header has been read and completely checked by IOCS. (1)
Necessary Processing	Processing will be required if information in the miscellaneous field of the header must be checked.
Return Point	If no information is to be checked in the miscellaneous field, or if the routine has determined that the information is correct, re-entry should be at IORETURNTO. IOCS will then continue positioning the tape. If the routine has determined that the information in the miscellaneous field is incorrect, the routine should effect a loop to allow the operator to mount the correct reel. When the reel has been mounted, re-entry should be at IORETURNNO. IOCS will then check the new reel.
OUTPUT TAPE	
Exit Condition	The exit is made when a standard header has been created in the IOTRSHLBL area.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write the header (from IOTRSHLBL area) and a tape mark.

(1)   An exit can also be made to the Header Transfer Address by pressing Interrupt Key 253 at loop/message 30291. In this case, there will not be a valid header in IOTRSHLBL. If necessary, the specialized routine can determine whether or not a valid header has been read by interrogating the A bit at CSW13. This bit is set 1 if there is a missing label condition.

Header Transfer Address—Nonstandard Header, Beginning-of-Reel Routines

INPUT TAPE	
Exit Condition	The exit is made when the first record on tape has been read. (1)
Necessary Processing	The routine must determine if the record is a header, and if the information in the header is correct.
Return Point	If the routine has determined that the record is a header and that the information contained is correct, re-entry should be at IORETURNTO. IOCS will then continue positioning the tape. If the routine has determined that the record is not a header, re-entry should be at IORETURNNO. IOCS will then effect loop/message 30291. (If the record is a header, but the information in the header is incorrect, the routine must provide for handling this error condition. If the error procedure involves mounting a new reel, re-entry can be made at IOTRSEXIT after the reel has been mounted, and IOCS will then check the new reel.)
OUTPUT TAPE	
Exit Condition	The exit is made when the first record on tape has been read. (1)
Necessary Processing	The routine must determine if the record is a header and if the information in the header is correct. The new header must be created in the IOTRSHLBL area.
Return Point	If the routine has determined that the record is a header and that the information contained is correct, re-entry should be at IORETURNTO. IOCS will then write the new header (from IOTRSHLBL area) and a tape mark, if specified. If the routine has determined that the record is not a header, re-entry should be at IORETURNNO. IOCS will then effect loop/message 30290. (If the record is a header, but the information in the header is incorrect, the routine must provide for handling this error condition. If the error procedure involves mounting a new reel, re-entry can be made at IOTRSEXIT after the reel has been mounted, and IOCS will then check the new reel.)

(1)   An exit can also be made to the Header Transfer Address by pressing Interrupt Key 253 at loop/message 30290 or 30291. In this case, there will not be a valid header in IOTRSHLBL. If necessary, the specialized routine can determine whether or not a valid header has been read by interrogating the A bit at CSW13. This bit is set 1 if there is a missing label condition.

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Header Transfer Address—No Header, Beginning-of-Reel Routines

INPUT TAPE	
Exit Condition	The exit is made when the tape has been checked; the tape is at load point.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO.
OUTPUT TAPE	
Exit Condition	The exit is made when the tape has been checked; the tape is at load point.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO.

INPUT MULTIFILE TAPE	
Exit Condition	The exit is made when a tape mark and a standard header have been read, and when processing for the file has been completed. (2)
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. IOCS will then continue positioning the tape for sequential or nonsequential handling, as specified.

OUTPUT MULTIFILE TAPE	
Exit Condition	The exit is made only when an IOMFO is issued. A tape mark has been written, and a standard header has been created in the IOTRSHLBL area.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write a header (from IOTRSHLBL area) and a tape mark.

(1)   On multifile tapes, the specialized Header Transfer Address routine can determine whether exit is being made at beginning of reel or intermediate end of file by interrogating the file counter (CSF0003032) for zero.

(2)   An exit can also be made to the Header Transfer Address routine by pressing Interrupt Key 253 at loop/message 30295. In this case, there will not be a valid header in IOTRSHLBL. If necessary, the specialized routine can determine whether or not a valid header has been read by interrogating the A bit at CSW13. This bit is set 1 on a missing label condition.

INPUT MULTIFILE TAPE	
Exit Condition	The exit is made when a tape mark and the following record have been read and when processing for the file has been completed. (2) If a standard trailer is specified, IOCS has determined that the record is not a trailer. If a nonstandard trailer is specified, the user's end-of-reel routine has determined that the record is not an end-of-reel trailer.
Necessary Processing	The routine must determine if the record is a header.
Return Point	If the routine has determined that the record is a header, re-entry should be at IORETURNTO. IOCS will then continue positioning the tape for sequential or nonsequential handling, as specified. If a standard trailer is specified and the routine has determined that the record is not a header, re-entry should be at IORETURNNO. IOCS will then treat the record as a data record and will continue positioning the tape for sequential or nonsequential handling, as specified. If a nonstandard trailer is specified and the routine has determined that the record is not a header, re-entry should be at IORETURNNO. IOCS will then link to the End-of-File Transfer Address.
OUTPUT MULTIFILE TAPE	
Exit Condition	The exit is made only when an IOMFO is issued. A tape mark has been written.
Necessary Processing	The header must be created in the IOTRSHLBL area.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write the new header (from IOTRSHLBL area) and a tape mark, if specified.

(1)   On multifile tapes, the specialized Header Transfer Address routine can determine whether exit is being made at beginning of reel or intermediate end of file by interrogating the file counter (CSF0003032) for zero.

(2)   An exit can also be made to the Header Transfer Address routine by pressing Interrupt Key 253 at loop/message 30295. In this case, there will not be a valid header in IOTRSHLBL. If necessary, the specialized routine can determine whether or not a valid header has been read by interrogating the A bit at CSW13. This bit is set 1 on a missing label condition.

INPUT MULTIFILE TAPE	
Exit Condition	The exit is made when a tape mark has been read and when processing for the file has been completed. If the record following the tape mark is 95 characters or less and is not a tape mark, it is in the IOTRSHLBL area. If the record following the tape mark is more than 95 characters in length, the A bit at CSW13 has been set 1. If a standard trailer is specified, IOCS has determined that the record is not a trailer. If a nonstandard trailer is specified, it has been determined that the record is not an end-of-reel trailer.
Necessary Processing	If a standard trailer is specified, none. If a nonstandard trailer is specified, the routine must determine if the record is a data record (as opposed to an end-of-file trailer).
Return Point	If a standard trailer is specified, re-entry must be at IORETURNTO. IOCS will then continue positioning the tape for sequential or non-sequential handling, as specified. If a nonstandard trailer is specified and the routine has determined that the record is a data record, re-entry should be at IORETURNTO. IOCS will then continue positioning the tape for sequential or nonsequential handling, as specified. If a nonstandard trailer is specified and the routine has determined that the record is not a data record, re-entry should be at IORETURNNO. IOCS will then link to the End-of-File Transfer Address.
OUTPUT MULTIFILE TAPE	
Exit Condition	The exit is made only when an IOMFO is issued. A tape mark has been written.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO.

(1)   On multifile tapes, the specialized Header Transfer Address routine can determine whether exit is being made at beginning of reel or intermediate end of file by interrogating the file counter (CSF0003032) for zero.

End-of-File Transfer Address—Standard Trailer

INPUT TAPE	
Exit Condition	The exit is made when the processing for the file has been completed, and a tape mark and a standard end-of-file trailer have been read. (1)
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. The IOCS end-of-file routines will be executed next.

OUTPUT TAPE

Exit Condition	The exit is made when an IOCLS or an IOMFC is issued, and a standard end-of-file trailer has been created in the IOTRSHLBL area. The tape is positioned immediately after the last data tape record written.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write a tape mark, the end-of-file trailer (from IOTRSHLBL area), and a tape mark.

(1)   An exit can also be made to the End-of-File Transfer Address by pressing Interrupt Key 253 at loop/message 30293 or 30295.   In this case, there will not be a valid trailer in IOTRSHLBL.   If necessary, the specialized routine can determine if a valid trailer has been read by interrogating the A bit at CSW13.   This bit is set 1 on a missing label condition.

INPUT TAPE	
Exit Condition	The exit is made when the processing for the file has been completed, and a tape mark and the following record have been read. (1)
Necessary Processing	The routine must determine whether an end-of-file condition or a missing label condition exists.
Return Point	If the routine has determined that an end-of-file condition exists, re-entry should be at IORETURNTO. The IOCS end-of-file routines will be executed next. If the routine has determined that a missing label condition exists, re-entry should be at IORETURNNO. IOCS will then execute loop/message 30293 (if single file tape) or 30295 (if multifile tape).
OUTPUT TAPE	
Exit Condition	The exit is made when an IOCLS or an IOMFC is issued (a standard end-of-file trailer has been created in the IOTRSHLBL area). The tape is positioned immediately after the last data tape record written.
Necessary Processing	The nonstandard trailer must be created in the IOTRSHLBL area.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write a tape mark, the end-of-file trailer (from IOTRSHLBL area), and a tape mark.

(1) An exit can also be made to the End-of-File Transfer Address by pressing Interrupt Key 253 at loop/message 30293 or 30295. In this case, there will not be a valid trailer in IOTRSHLBL. If necessary, the specialized routine can determine if a valid trailer has been read by interrogating the A bit at CSW13. This bit is set 1 on a missing label condition.

End-of-File Transfer Address — No Trailer

INPUT TAPE	
Exit Condition	The exit is made when the processing for the file has been completed, and a tape mark has been read.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. The IOCS end-of-file routines will be executed next.
OUTPUT TAPE	
Exit Condition	The exit is made when an IOCLS or an IOMFC is issued. The tape is positioned immediately after the last data tape record written.
Necessary Processing	None.
Return Point	Re-entry must be at IORETURNTO. IOCS will then write a tape mark, end-of-file trailer, and a tape mark.

INPUT TAPE	
Exit Condition	The exit is made under one of the following conditions: 1. Standard trailers are specified and a standard end-of-reel trailer has been read. (1) or 2. Special standard trailers are specified and a tape mark and a standard end-of-reel or end-of-file trailer have been read. (1)
Necessary Processing	Processing is necessary only if special standard trailers are specified, in which case the routine must determine whether an end-of-reel or an end-of-file condition exists.
Return Point	1. If standard trailers are specified, IOCS must be re-entered at IORETURNTO. The IOCS end-of-reel routines will be executed next. 2. If special standard trailers are specified and the routine has determined that an end-of-reel condition exists, re-entry should be at IORETURNTO. The IOCS end-of-reel routines will be executed next. If special standard trailers are specified and the routine has determined that an end-of-file condition exists, re-entry should be at IORETURNNO. A transfer to the End-of-File Transfer Address will be executed by IOCS when the processing for the file has been completed.
OUTPUT TAPE	
Exit Condition	The exit is made when a reflective spot has been sensed on the output tape or when an IOFER is issued. A standard end-of-reel trailer has been created in the IOTRSHLBL area. The tape is positioned immediately after the last data tape record written.
Necessary Processing	Processing will be required if, under certain circumstances, the end-of-reel condition is to be ignored (i.e., the user may desire to write additional records on the tape before writing a tape mark).
Return Point	If the end-of-reel condition is to be accepted, re-entry should be at IORETURNTO. IOCS will then write a tape mark, the end-of-reel trailer (from IOTRSHLBL area), and a tape mark. If the end-of-reel condition is to be ignored, re-entry should be at IORETURNNO. IOCS will then return to the object program. (Each subsequent write operation for the file will result in an exit to the End-of-Reel Transfer Address until the end-of-reel condition is accepted.)

(1)   An exit can also be made to the End-of-Reel Transfer Address by pressing Interrupt Key 252 at loop/message 30293. In this case, there will not be a valid trailer in IOTRSHLBL. If necessary, the routine can determine whether a valid trailer has been read by interrogating the A bit at CSW13. This bit is set 1 on a missing label condition.

End-of-Reel Transfer Address—Nonstandard Trailer

INPUT TAPE	
Exit Condition	The exit is made when a tape mark and the following record have been read. (1)
Necessary Processing	The routine must determine whether an end-of-reel or an end-of-file condition exists.
Return Point	If the routine has determined that an end-of-reel condition exists, re-entry should be at IORETURNTO. The IOCS end-of-reel routines will be executed next. If the routine has determined that an end-of-file condition exists, re-entry should be at IORETURNNO. If the tape is a single-file tape, a transfer to the End-of-File Transfer Address will be executed by IOCS when processing for the file has been completed. If the tape is a multifile tape, a transfer to the Header Transfer Address will be executed by IOCS when processing for the file has been completed.

OUTPUT TAPE	
Exit Condition	The exit is made when a reflective spot has been sensed on the output tape, or when an IOFER is issued (a standard end-of-reel trailer has been created in the IOTRSHLBL area). The tape is positioned after the last data tape record written.
Necessary Processing	Processing will be required if, under certain circumstances, the end-of-reel condition is to be ignored (i.e., the user may desire to write additional records on the tape before writing a tape mark). If the end-of-reel condition is to be accepted, the nonstandard trailer must be created in the IOTRSHLBL area.
Return Point	If the end-of-reel condition is to be accepted, re-entry should be at IORETURNTO. IOCS will then write a tape mark, the end-of-reel trailer (from IOTRSHLBL area), and a tape mark. If the end-of-reel condition is to be ignored, re-entry should be at IORETURNNO. IOCS will then return to the object program. (Each subsequent write operation for the file will result in an exit to the End-of-Reel Transfer Address until the end-of-reel condition is accepted.)

(1) An exit can also be made to the End-of-Reel Transfer Address by pressing Interrupt Key 252 at loop/message 30293. In this case there will not be a valid trailer in IOTRSHLBL. If necessary, the routine can determine whether a valid trailer has been read by interrogating the A bit at CSW13. This bit is set 1 on a missing label condition.

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INPUT TAPE	
Exit Condition	The exit is made when a tape mark has been read.
Necessary Processing	The routine must determine whether an end-of-reel or an end-of-file condition exists.
Return Point	If the routine has determined that an end-of-reel condition exists, re-entry should be at IORETURNTO. The IOCS end-of-reel routine will be executed next. If the routine has determined that an end-of-file condition exists, re-entry should be at IORETURNNO. A transfer to the End-of-File Transfer Address will be executed by IOCS when processing for the file has been completed.
OUTPUT TAPE	
Exit Condition	The exit is made when a reflective spot has been sensed on the output tape, or when an IOFER is issued. The tape is positioned immediately after the last data tape record written.
Necessary Processing	Processing will be required if, under certain circumstances, the end-of-reel condition is to be ignored (i.e., the user may desire to write additional records on the tape before writing a tape mark).
Return Point	If the end-of-reel condition is to be accepted, re-entry should be at IORETURNTO. IOCS will then write a tape mark, end-of-reel trailer, and a tape mark. If the end-of-reel condition is to be ignored, re-entry should be at IORETURNNO. IOCS will then return to the object program. (Each subsequent write operation for the file will result in an exit to the End-of-Reel Transfer Address until the end-of-reel condition is accepted.)

IOTRSOPLBL (Output Tape Only)

Exit Condition	The exit is made when the tape is at load point and a standard header is specified in the file table. If there was a standard label on the tape, it will be in the label work area (CSB0000 or IOTRSHLBL). If there was no standard header on the tape, loop/message 30290 will have been given and Option 2 taken, and the A-bit of CSW13 will be OFF (as will the A-bit of IOTRSLNG99+4) to indicate that a valid label is not in the label area. (Exit is made by putting the address of the special routine in IOTRSOPLBL @1189.)
Necessary Processing	If the object program wishes to fill in a tape serial number when no standard label is on the tape, processing will be required (otherwise a tape serial number of **** will be created). If a tape serial number is to be filled in, a four-position unsigned number should be placed in CSB0002 (or IOTRSHTSER @925-928). This number will be used as the tape serial number for the tape being processed.
Return Point	If the output header is correct, or if a new tape serial number has been placed in the label, re-entry is at IORETURNTO. IOCS will then create a new header label.

If the routine has determined that the information is incorrect, the routine should give an IODEC linkage to allow the operator to mount the correct reel. When a new reel has been mounted, re-entry should be at IOTRSEXIT. IOCS will then check the new reel. |

IOREDUNCHK

Exit Condition	One hundred unsuccessful attempts to read a record, or five unsuccessful attempts to write a record, have been made by CSERR; or a memory redundancy has been found prior to the writing of a checkpoint record by CSMRD. The memory area involved is being searched, and a redundant character has been found; the bit structure has been typed. (An exit will be made for each redundant character found in the area concerned.)
	
	The following information is available in the five-position field IOREDUNAD:
	
	1. <u>High-order position</u>
	
	    The IOCS-converted character which will replace the redundant character if re-entry is at IORETURNTO.
	
	2. <u>Address portion</u>
	
	    The memory location of the redundant character. The bit structure of the redundant character is not changed at this point.

Necessary Processing	If the IOCS-converted character is to replace the redundant character, no processing is necessary. (IOCS reverses the "C" bit of the redundant character to create a valid character, or if the character has no bits or a "C" bit only, it is replaced with an asterisk.)
Return Point	If the IOCS-converted character is to replace the redundant character, re-entry should be IORETURNTO. If the routine has replaced the redundant character at the memory location specified with a <u>valid</u> 7080 character, re-entry should be at IORETURNNO. The bit structure of the character will not be changed by IOCS. (However, the character will be checked for validity.) When the entire memory area concerned has been searched and each redundant character has been replaced, loop/message 30210, 30211, or 30940 will be executed, unless automatic dumping has been specified.

CSA90 (Control Card Exit)

Exit Condition	The exit is made when a correct label control card has been read.
Necessary Processing	The routine may obtain information from the card which may be used by the object program.
Return Point	Re-entry must be at IORETURNTO.

NOTE: No exit is made for a Date or End control card.

The label work area (CSB0000) is 95 positions in length, and will contain the header or trailer labels, if such are indicated, when IOCS transfers to the Header, EOR, or EOF Transfer Addresses. The fields in the label work area will be set up as follows:

Tag	Positions	Information Contained
IOTRSHIDFR	1-5	Label Identifier (1 * * * b or 10064)
IOTRSHTSER	6-9	Tape Serial Number
	10	Slash (/) field separator
IOTRSHFSER	11-14	File Serial Number
	15	Dash (-) field separator
IOTRSHRSEQ	16-18	Reel Sequence Number
	19	blank
IOTRSHFIDN	20-29	File Identification Name
	30	blank
IOTRSHYEAR	31-32	Creation Year
IOTRSHDAY	33-35	Creation Day
	36	Dash (-) field separator
IOTRSHRET	37-39	Retention Cycle
	40	blank
	41-52	Record Format
IOTRSCIND	53	Checkpoint Indicator
	54	blank
IOTRSHMISC	55-95	For special information (55-59 Reserved for IOCS)

This is the format of standard headers, and may be checked when an exit is made to the Header Transfer Address.

HOW TO USE THE PREASSEMBLED IOCS

Establishing Communication

Specify 7080 IOCS

The first IO macro-instruction used in the program being assembled must be the macro-instruction IOCS. This macro-instruction will establish the machine mode relationship between the object program and the IOCS.

Tape Table

The Tape Table for the preassembled IOCS is assembled with the object program, and must start at actual memory location 000500. The following entries will establish the required Tape Table:

```
LASN        @500
IOTA              ⎫   as many as
                  ⎬   required
IOTA        END   ⎭
IOTS
```

The Main Section of the Tape Table must be 200 characters or less in length (the total length is variable).

File Tables

One file table must be assembled with the object program for each tape file to be used by that program. The file tables may be located anywhere in memory above the Tape Table, except in IOCS, i.e., from 000500 to 025000, and the last 2000 positions of memory. File tables may be generated during the assembly through the macro-instructions IOFTA, IOFTB and IOFTC. The preparation of these macro-instruction headers may be accomplished simply by using Form X22-6913 which was prepared for this purpose.

Functional Linkages

The functional linkages between the object program and IOCS will be established as required by the object programmer through the linkage macro-instructions. IOCS Housekeeping (CSHSK) must be executed before any other functional linkage is made to IOCS. This is accomplished through the macro-instruction IOLNK to CSHSK.

Assembling the Object Program

The 7058 Processor must be used to assemble an object program for use with the 7080 IOCS. It will be necessary to perform a librarian run of the 7058 Processor to include the IOCS library.

Prior to testing the assembled object program, it will be necessary to include the program deck of the preassembled IOCS. This deck must be placed before the program cards of the object program. The combined program will now be ready to test.

NOTE: The reader is referred further to the checklist for the use of IOCS, contained in the Introduction to this manual.

CSAAA is a subroutine which is included by means of the macro-instruction IOCS. This subroutine contains Common Linkage Points and Work Areas with associated tags.

The label work area (IOTRSHLBL or CSB0000) with associated tags is described in the section, "Exits to Specialized Routines."

The file table work area (CSF0000) with associated tags is described in the section, "IOCS80 File Tables."

A description of the Common Linkage Points and Work Areas (CSAAA) follows:

Tag	Positions	Description
CSB3001	5	First entry in the Tape Table.
CSW18	5	Tape Table entry for the checkpoint file table.
CSW21	5	Tape Table entry for the program tape.
CSW02	5	Current date.
CSW03	6	Program identification.
CSM10210	5	Message 10210.
CSW091 CSW092	1	1 bit 0: Do not type Type B messages. 1 and 2 bit 0: Ignore Type B messages.
CSW101 CSW102	1	1 bit 0: Do not type Type C messages. 1 and 2 bit 0: Ignore Type C messages.
CSW111 CSW112	1	1 bit 0: Do not type Type D messages. 1 and 2 bit 0: Ignore Type D messages.
	1	1 bit 0: 160K machine. 1 bit 1: 80K machine.
CSW13 (IOTRSLNG99+4)	1	A bit 1: Missing label.
CSW14	2	Size of stacking table.
CSW15 (IOSPC)	4	Starting point counter if other than 0000.
CSW16	5	Card reader address if other than 0100.
CSA01	5	Entry to the Housekeeping routines (CSHSK).

Tag	Positions	Description
CSA02	5	Entry to Phase-to-Phase Housekeeping (CSPHASEHSK)
CSA90	5	Exit from Control Card routine.
IOTRSEXIT	5	Re-entry from IOTRSOPLBL routine.
IOTRSOPLBL	5	Exit to examine standard output header.
IORETURNAD (CSD0099)	5	Exit point from IOCS80.
IORETURNNO	5	Re-entry from special object program routines (answer is no).
IORETURNTO	5	Re-entry from special object program routines (answer is yes).
IOMRD00001	5	Object program entry to checkpoint.
IOMRSSTART	5	Normal restart entry from memory.

CSHSK - HOUSEKEEPING

Functions Performed

The CSHSK routine handles all phases of input/output initialization, and will perform the following functions:

1. Initialize IOCS routines.

2. Check Tape Table and file tables.

3. Read control cards.

4. Check header labels.

5. Fill input areas.

6. Take a checkpoint at the end of CSHSK.

Initialization of IOCS Routines

Switches and addresses for all routines are initialized to allow IOCS to remain in memory while changing from one program to another.

Checking of Tape Table and File Tables

Information indicated in the Tape Table is compared to the file tables, and the file tables are initialized. Initialization of file tables includes:

1. Setting up the select address.

2. Setting up alternate tape addresses.

3. Initialization of error and end-of-reel counters.

4. Setting up of the scheduler transfer address.

Reading of Control Cards

Control cards must be provided for each input tape with standard headers. If headers appear only on output tapes, only a Date Card and an End Card need be provided. Control cards may be either of two types: file serial and cycle checking. The format of the control cards is as follows:

<u>DATE CARD</u> (1)

Card Columns	Information Needed
1 – 6	Object program identification.
7	blank.
8 – 9	Current year (00 – 99).
10 – 12	Current calendar day (001 – 366).
13 – 80	Not used by IOCS.

FILE SERIAL HEADER CONTROL CARDS

Card Columns	Information Needed
1 – 10	File Identification Name. (Must be identical to the file identification in the file table.)
11	blank.
12 – 15	File Serial Number which each header label of the specified input file is to contain.
16 – 80	Not used by IOCS.

The control card is read and a search is made for an input file table containing a File Identification Name identical to the one specified in columns 1 – 10 of the control card. When this file table is found, the file serial number in columns 12 – 15 of the control card is placed in the file serial number field of the file table.

CYCLE HEADER CONTROL CARDS

Card Columns	Information Needed
1 – 3	Cycle Number. (The three-digit number which the header label on the first reel of the specified input file is to contain.)

---

(1) The Date Card must precede the header control cards. If a valid date is present at CSW02, a Date Card will not be read.

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Card Columns	Information Needed
4 - 10	File Identification Name. (Must be identical to the File Identification Name specified by the seven low order positions of the File Identification field of the file table.)
11	* or blank. (An asterisk is punched in this column if the cycle number specified in columns 1 - 3 is to be increased by one and placed in the three high-order positions of every output file table.)
	Column 11 is left blank if the cycle number specified by columns 1 - 3 is to be increased by one and placed only in the three high-order positions of the output file table which contains a File Identification Name identical to the one specified in columns 4 - 10 of the control card.
12 - 15	blank.
16 - 80	Not used by IOCS.

If columns 1 - 3 contain a numerical field and columns 12 - 15 are blank, a search is made for an input file table containing a File Identification Name identical to the one specified in columns 4 - 10 of the file identification field. When this input file table is found, the cycle number in columns 1 - 3 is placed in the three high-order positions.

After the cycle number is placed in the input file table, it is increased by one and placed in an output file table(s) according to the contents of column 11 of the control card.

END CONTROL CARD

This must be the last card of the control card deck.

Card Columns	Information Needed
1 - 6	Object Program Identification.
7 - 15	blank.
16- 18	END.
19 - 80	Not used by IOCS.

The End card specifies that all control cards have been read. IOCS then checks all input files containing standard headers to determine whether or not a control card has been supplied.

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If any file tables have not been updated, a message will be typed, and control cards must be supplied before CSHSK can continue.

Label Checking

(See CSTRS section of this manual.)

Priming

If the tape is input, the input areas will be filled by CSHSK if priming is specified in the file table. If priming is not specified, each input area should be primed before processing is begun.

Taking of Checkpoint

An automatic linkage to the checkpoint routine will be given at the completion of CSHSK if a checkpoint tape is specified.

Special Considerations

NORWDb Files

If operand X13 of the file table macro-instruction is NORWDb, specifying that the associated tape is not to be rewound during Housekeeping, CSHSK will perform the following functions:

1. Initialize the File Table

    a. Set up the select address.
    b. Set up the alternate tape addresses.
    c. Error, record, file and other counters will not be initialized.
    d. Set up the scheduler transfer address.

2. Prime Input Files, if Indicated in the File Table

    Label checking will not occur. It is assumed that any NORWDb tape is positioned immediately prior to data, i.e., not in front of a label. If a NORWDb tape is improperly positioned, an input label will be read as data and an output label will be destroyed by data.

DELAYOPEN

Operand X19 of the file table macro-instruction IOFTA may specify a delayed-open option. This option may be useful when it is not known during Housekeeping if a particular file will be used.

Housekeeping for files operating under the delayed-open option will be incomplete in that label checking or label creation and priming will not occur. The file table will be initialized in all respects including the updating of label control information, i.e., label control cards will be required for input files.

Files operating under the delayed-open option must be represented in the Tape Table through a base tape entry, and may be opened in the following manner:

1. Input Files: Through the functional linkage IOHLD with a second operand of OPEN or a second operand of EOFCK. (Note: If the functional linkage IORD is used and priming is specified, the priming will precede the execution of the IORD request. Hence, the first record will have been lost. The IOGET linkage must not be used to open such a file.)

2. Output Files: Through a normal output request IOWR, or any series of requests, e.g., IOPUT, which result in the normal output request IOWR. (Note: IOPUT cannot be used to open a file which has previously been closed.) Output files may also be opened through the functional linkage IOHLD with a second operand of OPEN.

The operations IORWD, IORUN, IOCLS, IOFER, IOMFC, IOMFO, and IOHLD without a second operand will be ignored if addressed to a file which has not been opened, or is at load point after having been closed. Any other functional linkage except IOGET, IOPUT or IOBSD will cause the opening of the file.

NOTE: CSHSK automatically opens all files in the sequence given in the Tape Table.

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Functions Performed

The main function of CSDTS is to execute all input/output operations per-
taining to non-error handling of data records. This function includes
scheduling input/output operations (depending on the availability of the
channels), and checking such operations for the possibility of errors,
tape marks, and reflective spots. In addition, CSDTS contains linkage
to other sections of IOCS to perform certain special functions. Since the
correct application of CSDTS will result in full utilization of the simul-
taneous read/write/process features of the 7080, CSDTS is the most
important section of IOCS.

Commands Executed by CSDTS

Every input/output function involving tapes connected to the 7080 through
channels will be performed by CSDTS. To call for the execution of a
particular function, the user need only insert a simple macro-instruction
at the appropriate point in main-line processing.

BEGINNING OF FILE OPERATIONS

In all cases when a file is being handled for the first time (i.e., during
CSHSK or at the beginning of each new file on a multifile tape), the file
table will be modified so that the next records read or written will use
the input/output areas in the sequence given in the file table. That is,
the first record will use area one, the second record will use area two, etc.

If priming is specified in the file table, the first "n" records of the input
file will be read into the "n" input areas specified for the file. If a tape
mark is encountered during priming, CSEOF will be entered. If the tape
mark is also the first record and an end-of-file condition exists, a transfer
will be made by CSEOF to the appropriate specialized routine. The pro-
grammer can ascertain the occurrence of this last condition by verifying
that the Record Counter is zero.

If priming is not specified for an input file, CSDTS assumes that all input
areas will be filled by a series of read linkages which will be given in the
object program before any processing is performed on the file. It also
assumes that the number of such read linkages will be equal to the number
of input areas given in the file table.

WHEN TO ISSUE A READ OR WRITE COMMAND

The only contact CSDTS has with main-line processing is through the
linkages used to call for the execution of an I/O function. To make certain
that correct processing is performed in the areas of execution of functions,
keeping of counts, and checking for errors, it is absolutely necessary that
a call to read be given as soon as an input area becomes available to receive
a new record and a call to write be given as soon as an output area is filled.

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These calls must be given before any additional processing is started. Use of Get/Put will insure that read and write requests are issued as soon as they are required.

Modes of Operation

All files are operated under either of the following four modes:

1. Stacking.

2. Initiate.

3. Get/Put with initiate input/output.

4. Get/Put with stacked input/output.

Stacking Mode

When a read or write request is made for a file which is operating in the stacking mode, in most cases a record will be made of the request in the stacking table associated with the channel specified, and an immediate return made to the object program. Exception to this procedure occurs under two conditions:

1. When the associated channel is not busy.

2. If there is no input/output area associated with this file available to main-line processing.

If the associated channel is not busy, the requested operation will be started. A return will be made to main-line processing at this time. If there is no input/output area available, control will not be returned to main-line processing until an area is available. This condition is called a force condition.

Only reading and writing requests based on input/output area addresses given in the file table are subject to stacking. Any other type of request addressed to a file operating in the stacking mode will in effect cause the immediate execution and checking of all stacked requests for this file. The current request will be initiated. It will be checked prior to a return to the object program (except IORDS, IOWRS, IORWD, IORUN, IOFSF, IOBSF and IODMP).

The number of requests which are subject to stacking at any time is equal to the number of input/output areas used by the file minus one. CSDTS checks to see that the limit of the stacking tables is not exceeded prior to the addition of a request. If the limits of the table would be exceeded by the new entry, the first entry in the table will be executed prior to the addition of the new entry and the subsequent return to the object program.

Initiate Mode

Under the initiate mode, any operation called for by linkage from main-line processing will be started regardless of the availability of the channel. If the associated channel is not ready, CSDTS will overlap the waiting time by permitting other channels to interrupt. In addition to starting the new operation, a linkage under the initiate mode always checks the last operation performed on the channel (unless it had already been checked).

Although an operation is started under the initiate mode, it may not be completed before a return is made to main-line processing, unless HOLD is specified in the linkage. This immediate return to main-line processing permits tape start time and RD/WR time to be overlapped with processing time.

If two or more input/output areas are assigned to a file operating in the initiate mode and each request must be started prior to a return to the object program, there will always be an input/output area available to the object program. If an initiate mode file uses only one input/output area and HOLD is not specified in the read/write linkage, a return may be made to the object program prior to the completion (and checking) of the request. Prior to processing any data from such an area, a linkage should be made to IOCS (IOHLD) to check the operation.

There is no advantage to the use of initiate mode if more than one area is assigned to the file.

Get/Put Mode

The Get/Put mode provides for the automatic deblocking of input data records and blocking of output data records, and will handle any records which conform to tape format specifications. The necessary reading and writing of tape records and input/output area alternation are handled automatically. Each IOGET linkage will produce a record in the work area. Each IOPUT linkage will cause a record to be moved from a work area to an output area.

The following options may be used with the Get/Put routines and are specified in the file table macro-instruction IOFTB:

1. Both a Get and a Put routine may be associated with a single file table. This permits the input/output nature of the file to be reversed (see IOMIP and IOMOP) and the Get/Put requests to be executed without using two file tables.

2. A single work area address may be specified in the file table. The object programmer may effect certain efficiencies by restricting his work area usage to this single area.

    Additional work areas may be used if necessary. These areas are specified in the individual Get/Put linkages (IOGET, IOPUT). However, this additional area usage must be indicated in IOFTB operand X16.

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3. A Backspace Data Record request, IOBSD, may be made of IOCS. This linkage permits the object programmer to obtain records previously handled.

4. The final output tape record may be padded with either blanks or nines (fixed-length data records). The object programmer may avoid the handling of input padding records (see IOFTB operand X15). Padding may be avoided entirely, if desired.

5. Records may be prepared for 720 printer operation. A maximum blocking factor may be specified, even for variable-length data records. The record mark of the final data record of each block may be deleted as required for 720 printer operation.

Input files operating in the Get/Put mode are normally closed automatically by linking (IOGET) to the Get/Put routine once after the last data record has been processed. The end-of-file condition is indicated by an IOCS transfer to the object program end-of-file routine.

Input files may be prematurely closed by using the IOCLS (close) macro-instruction.

Output files operating in the Get/Put mode are closed after having placed the last data record in the output area (through an IOPUT request) by an additional IOPUT linkage with a third operand of CLSFINAL. If padding is required, it will be added to the final block. This block will then be written and the file closed.

An IOCLS (close) request specifying an output file operating in the Get/Put mode will cause an immediate close of that file without having written the final record. This is an improper use of the IOCLS linkage.

A Backspace Data Record request, IOBSD, may be made of IOCS. This linkage will cause the modification of the Get/Put counters so that a subsequent IOGET or IOPUT request will cause the movement of a previous record. No data record is moved by the IOBSD linkage.

The Get/Put routines use CASUs 10 and 11, and therefore must move the starting point counter. On return to the object program, the starting point counter is restored to the contents of CSW15. This field is initialized as 0000. If SAVE is specified as the third or fourth operand, respectively, of a GET or PUT linkage, coding is generated to save the current setting of the starting point counter in this field.

Counters and Indicators Used by CSDTS

Record Counter

The record counter contained in each file table is updated by CSDTS each time an I/O operation which passes over data tape records is executed. At any given time, therefore, the counter specifies the exact position of the tape. The counter is initially set to zero. The record counter for an input tape is increased by one each time a record is read or forward

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spaced over; the record counter for an output tape is increased by one each time a record is written. The record counter for an input or output tape is decreased by one each time the file is issued a backspace command. The record counter is reset to zero at the beginning of each reel of a multireel file, and whenever a tape is repositioned to the beginning of a reel (RWD) or the beginning of a file (BSF).

Force Counter

The force counter specifies the number of I/O areas available for processing at any given time, and enables CSDTS to perform the following functions:

1. Automatically make certain that the object program always has an input record or output area available if the stacking mode is used. A return will not be made to the object program until this condition is satisfied.

2. Automatically make certain that all records are processed before the object program is made aware that it has reached an input end-of-reel, if Mode 2 end-of-reel handling is specified, or that it has reached an input end of file. This checking is performed for files using either the stacking mode or the initiate mode. If a tape mark and trailer (or a header on a multifile tape) is encountered, the force counter is interrogated. If the counter is not zero, areas remain to be processed. Even though the tape mark was read correctly, the force counter will not be stepped down as it would be for a normally checked operation.

A return will be made to the object program without a prior transfer to the end-of-reel or end-of-file specialized routines. As additional requests are made for this file, the force counter will be stepped up until all data has been processed. At this time a transfer will be made to the special end-of-reel or end-of-file routine specified in the file table.

For a file operating in the Get/Put mode, a transfer will not be made to the end-of-reel routine if Mode 2, or end-of-file routine, until an IOGET request is made subsequent to the IOGET which produced the final data record in the work area, i.e., the object program will have processed all of the data for the file before the transfer is made to the End-of-File or End-of-Reel Transfer Address.

Area Rotation

CSDTS automatically keeps track of the next input/output area address to be used in the file table. The areas are used in circular fashion, i.e., after the last area is used, the rotation routine is such that the first area will be used next. If the Get/Put system is not used, the object program must contain the mechanics required to use the areas in exactly the same sequence and to initialize the area usage rotation according to the requirements indicated in the table on the next page.

It is possible to share the same three input/output areas between an input and an output file by specifying a C in operand 7 of both IOFTB macros. In this case, the areas must be defined by the object programmer through the use of the IOFTC macros. The same three areas should be listed in the same order in each IOFTC. IOCS will read and write records from the three areas in the proper sequence, but will prime only two of them. For this procedure to work properly, the programmer must either specify Initiate mode for the output file, or, after processing a record give the IOWR request before the IORD request. If Get/Put mode is used, Initiate mode must be specified for the output file.

Generally, all functional linkages which cause tape movement with no transfer of data between memory and tape will be handled in the Hold mode (except IORWD, IORUN, IOBSF and IOFSF). At the completion of such requests (including IORWD, IORUN, IOBSF and IOFSF, but not IOFER), the associated file table will be initialized. This initialization will include area rotation (the next record will use area one), priming if indicated in the file table (except IORWD, IORUN and IOFER), and initialization of Get/Put.

Effects of Functional Linkages

The following table summarizes the functional linkages according to the effect each has on stacking, the force counter, area usage, priming, etc.

N signifies "NO," Y signifies "YES," and numbers in parentheses refer to notes following the table.

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Operation Class	Operation	Operation Subject to Stacking	Stacking Table Cleared Prior to Execution	Initialization of Force Counter and Area Rotation after Execution	Automatic Open on Following Operation	Priming (If Indicated in File Table) Concludes Execution of this Operation	Operation Buffered after Clearing the Stacking Table	Operation may be used with EOR Mode 2	Operation may be used with Alternate Reels on Different Channels
1	IORD	Y	N	N	N	N	Y(1)	Y	Y
	IOWR	Y	N	N	N	N	Y(1)	Y	Y
	IODMP	N	Y	N	N	N	Y(1)	N	Y
	IORDS	N	Y	N	N	N	Y(1)	N	Y
	IOWRS	N	Y	N	N	N	Y(1)	N	Y
2	IOBSP	N	Y	Y	N	Y	N	N	N
	IOBSF	N	Y(2)	Y	N	Y	Y(1)	N	N
	IOFSP	N	Y	Y	N	Y	N	N	N
	IOFSF	N	Y(2)	Y	N	Y	Y(1)	N	N
	IOPOS	N	Y(2)	Y	N	Y	N	N	N
3	IOCLS	N	Y	N(4)	Y(4)	N	N(3)	Y	Y
	IOFER	N	Y	N	N	N	N	Y	Y
	IOMFC	N	Y	N	N	N	N	Y	Y
	IOMFO	N	Y	Y	N	Y	N	Y	Y
4	IOHLD (6)	N	Y	N	N	N	N	Y	Y
	IORWD	N	Y	N(4)	Y(4)	N	N(3)	Y	Y
	IORUN	N	Y	N(4)	Y(4)	N	N(3)	Y	Y
5	IOGET	N	N	N	N	N	N(5)	Y	Y
	IOPUT	N	N	N	N	N	N(5)	Y	Y
	IOBSD	N	N	N	N	N	N	N	Y

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Note 1:   If the functional linkage contains the operand HOLD, the re-
quested operation will be completed and checked prior to a
return to the object program. To this extent, the operation may
be considered to be unbuffered.

Note 2:   In these cases, any stacked requests for the file involved will be
removed but not executed.

Note 3:   Control will be returned to the object program when the rewind
has begun.

Note 4:   Any Class 1 or 2 request specifying a file previously closed will
cause that file to be reopened (including label checking and
priming, if specified in the file table). The initialization of the
force counter and area usage indication will take place on the
succeeding open.

Note 5:   Input/output operations are buffered, but not data record move-
ment.

Note 6:   The IOHLD request addressed to a file which was previously
closed, or to a file on which a delayed open was indicated
during the execution of Housekeeping, will cause that file to
be opened (including label checking and priming, if specified
in the file table). This function is performed only if the
second operand of IOHLD is not omitted or blank.

Note 7:   May not use count control.

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Record Length Checking

CSDTS provides for checking the length of data tape records read or written as a result of any of the following linkages:

1. IORD or IOWR.

2. IOGET or IOPUT, if CKLNG is specified in the file table.

3. IORDS or IOWRS, if CKLNG is the fourth operand of the macro-instruction.

This checking is performed before the check for error and end-of-file conditions, and also after each retry if an error is detected. If any record read exceeds the size of the input area and ten-character buffer, a message will be typed and a waiting loop entered.

Fixed-Length Records

Each I/O area must be preceded by the four-character address of the position immediately following the area. Each I/O area must be followed by a group mark and a buffer area of at least ten characters, ending in a 4 or 9 position.

EXAMPLE 1: A 33-position area for fixed-length records is defined as follows:

TAG	OPERATION	NUM	OPERAND	COMMENTS
	NAME	1		
	ACON4		T3	
T1	NAME	0	T2	
T2	RCD	33		
T3	CON	1	‡	
		11		Buffer

EXAMPLE 2: An 80-position area for fixed-length records is defined as follows:

TAG	OPERATION	NUM	OPERAND	COMMENTS
	NAME	1		
	ACON4		T3	
T1	NAME	0	T2	
T2	RCD	80		
T3	CON	1	‡	
		9		Buffer

The first three characters of each variable length data tape record must contain a tape length count, constructed as follows:

a. The length of the record is converted into a four-character address.

b. Since variable length records must be divisible by five, the units position can only be 0 or 5. If the units position is 0, minus zoning must be placed over the tens position. If the units position is 5, plus zoning must be placed over the tens position.

c. Place the thousands, hundreds, and tens positions as the first three characters in the tape record.

EXAMPLE OF CONVERTING LENGTHS			
5-Character Length of Tape Record	4-Character Length of Tape Record	Proper Zoning Over Tens Position	Characters Placed in Tape Record
00105	0105	01$\overset{+}{0}$5	01$\overset{+}{0}$
02000	2000	2$\overset{-}{0}$00	2$\overset{-}{0}$0
10000	‡000	‡$\overset{-}{0}$00	‡$\overset{-}{0}$0
13535	T535	T5$\overset{+}{3}$5	T5C

Variable length input and output areas should be defined so that the total area will include a ten-character buffer area as the last ten characters. The total area should equal the maximum record length plus ten.

CSTRS—TAPE REEL CONTROL SYSTEM

CSTRS checks and positions each tape used by the object program. IOCS will process tapes which contain standard header labels, nonstandard header labels or no header labels. It is recommended that standard header labels be used on all input and output tapes to maximize the automatic handling of tapes at beginning of file and beginning of reel.

Standard Header Labels

When a tape is to be used as a data tape or program tape, the appropriate standard data tape header or program tape header, followed by a tape mark, must be written on it. The format of these header labels is presented in Figure 5.

FIELD NO.	POSITIONS	CONTENTS	DESCRIPTION	EXAMPLE
1	1-5	1***b or 10064	Header Identifier	1***b (data tape) 10064 (program tape)
2	6-18	xxxx/xxxx-xxx	Tape Serial Number, File Serial Number, and Reel Sequence Number	0123/0255-003
	19	blank		
3	20-29	xxxxxxxxxx	File Identification	PAYRLMASTR
	30	blank		
4	31-39	xxxxx-xxx	Creation Date and Retention Cycle	60107-030
	40	blank		
5	41-53	x-xxxx-xxxx-x	Record Format	F-0080-0001-C
6	54	blank		
	55-59		Recommend these positions be reserved for the future use of IOCS.	
7	60-80	Miscellaneous	These 21 positions can be used for any special information desired on data tape header labels. Positions 61-80 can be used for instructions on program tape header labels.	

Figure 5. Standard Header Label Format.

Field 1, Label Identifier (1*b or 10064)**

This field identifies the record as a header label. The data tape header contains "1***b" in this field, and the program tape header contains "10064". The characters in this field are also used for the following purposes:

1. The "1" in the first position of either header identifier will cause skipping to channel one when writing the label on a printer under program control.

2. The program tape identifier "10064" will cause a transfer to memory location 00064 when the LOAD key is depressed.

**Field 2, Tape Serial Number, File Serial Number,
and Reel Sequence Number (xxxx/xxxx-xxx)**

1. The four-digit tape serial number is the number initially assigned to the tape when it enters the system.

2. The four-digit file serial number is the tape serial number of the first reel of the associated file. For example, if the tape serial number for the first reel of a file is 0255, the file serial number field in the header label for the first reel and for each succeeding reel in the file will contain 0255.

3. The three-digit reel sequence number specifies the order of the reel within a given file, i.e., 001, 002, 003, etc.

Field 3, File Identification (xxxxxxxxxx)

Field 3 is a distinct, ten-character name identifying the file. The first three positions of this file name may be a three-digit cycle number, in which case the other seven positions may be used for the distinct identification. If cycle numbering is used, a file is given the cycle number 001 when it is initially created; each time the file is updated the cycle number is increased by one.

Field 4, Creation Date and Retention Cycle (xxxxx-xxx)

1. The first two digits of the five-digit field specify the year (00-99) in which the file was created. The remaining three digits specify the number of the calendar day (001-366) on which the file was created.

2. The three-digit field specifies the number of days the file is to be retained after the creation date.

Field 5, Record Format (x-xxxx-xxxx-x)

The record format field contains information pertaining to the records in a file.

1. The first position specifies whether the file consists of fixed-length records or variable-length records. "F" is entered for fixed-length records and "V" for variable-length records.

2. The first four-digit field specifies the data record length for fixed-length records or the maximum data record length for variable-length records.

3. The second four-digit field specifies tape record length and/or format as follows:

   a. For fixed-length unit tape records not ending in record marks, this field contains 0000.

   b. For fixed-length unit tape records ending in record marks, and for variable-length unit tape records, this field contains 0001.

   c. For fixed-length blocked tape records, this field contains the tape record length (data record length multiplied by blocking factor).

   d. For variable-length blocked tape records, this field contains maximum tape record length.

4. The last position specifies whether or not the tape is a checkpoint tape. If the tape contains or will contain checkpoint records, this position contains "C". If the tape is not a checkpoint tape, the position contains a blank.

Field 7, Miscellaneous

The remaining 21 positions can be used in any way desired by an installation. (See "IOCS80 Exits to Specialized Routines.")

In addition to the standard header label and tape mark which are at the beginning of each reel, a standard header followed by a tape mark must precede each data file on a multifile tape.

FIELD NO.	POSI- TIONS	CONTENTS	DESCRIPTION
1	1-5	1***b	Header Label Identifi- cation
2	6	blank	
3	7-19	Record Count per file Skip Count per reel File Count per reel Error Count per reel	
	20-80	Same as Standard Header	

Figure 6. Intermediate Header Label format.

Nonstandard Header Labels

A nonstandard header may be any record which is not a tape mark and is between 15 and 95 characters long.

IOTRS will read nonstandard headers from input tapes and write non-standard headers on output tapes. However, routines must be provided in the object program to check these headers and to create nonstandard headers for output tapes. (See Header Transfer Address, IOCS80 Exits to Specialized Routines.")

In addition to the nonstandard header label at the beginning of each reel, a nonstandard header must precede each file on a multifile tape.

No Header Labels

IOTRS will process tapes which do not contain header labels at the beginning of each reel or file. (See "IOCS80 Exits to Specialized Routines.")

CSEOF performs operations which are necessary when a tape mark is encountered in reading data tape records, or when a reflective spot is sensed in writing data tape records. CSEOF also performs operations which are necessary as a part of special end-of-file functions requested by macro-instructions IOCLS, IOMFC, IOMFO, IOFER, IORWD and IORUN.

IOCS will process tapes which contain standard labels, nonstandard labels, or no labels. It is recommended that standard labels be used on all input and output tapes to maximize automatic handling of tapes.

Standard Trailer Labels

In a standard labeling system, a tape mark, a label, and another tape mark are written after the last data tape record of a file or reel. Standard labels on input tapes are read and checked automatically by CSEOF; standard labels on output tapes are created and written automatically. If standard labels are used, but special handling is specified, CSEOF transfers to the object program end-of-reel routine whenever a trailer is read. There the object programmer determines whether an end-of-file or an end-of-reel condition exists. If return is to IORETURNTO, CSEOF assumes this is an end-of-reel condition. If return is to IORETURNNO, CSEOF assumes this is an end-of-file condition.

FIELD NO.	POSI- TIONS	CONTENTS	DESCRIPTION
1	1-5	1▢▢▢b	Trailer Label Identifi- cation
2	6	R or F	Termination Code
3	7-19	Record Count per file Skip Count per reel File Count per reel Error Count per reel	
4	20-22		Reserved for future use by IOCS
5	23-80	Miscellaneous	

Figure 7. Standard Trailer Label format.

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Nonstandard Trailer Labels

In this case, a tape mark, a nonstandard label, and another tape mark must follow the last data tape record of a file or reel. A nonstandard label may be any record which is not a tape mark and is 95 characters or less in length. CSEOF will write nonstandard labels which are created by the object program in the IOTRSHLBL area. Routines must be provided by the user to check nonstandard trailers on input tapes and to determine whether the tape is at end of file or end of reel.

No Trailer Labels

CSEOF will not process multifile tapes which do not contain trailers. CSEOF will, however, process single-file tapes which do not contain trailer labels. In this case, the user must provide routines for each input tape to determine whether the tape is at end of file or end of reel.

When nonstandard or no trailer labels are used, CSEOF will transfer to the object program end-of-reel routine when a tape mark is encountered on an input tape. The object program must indicate an end-of-reel or end-of-file condition to CSEOF by a return to IORETURNTO or IORETURNNO, respectively.

General CSEOF Procedures

The sequence of operations performed varies according to the linkage by which CSEOF is entered. The processing necessary in the special end-of-file, end-of-reel and header routines is described more fully in the section, "IOCS80 Exits to Specialized Routines."

End-of-Reel Procedures

INPUT TAPE

There are two end-of-reel modes which may be processed by IOCS80. The object programmer should indicate the mode he desires in the file table end-of-reel-mode indicator. If Mode 2 is indicated, the programmer should consult the table in the CSDTS section of this manual before using special operational requests.

Under Mode 1, when an end-of-reel condition is recognized, CSEOF transfers immediately to the object program end-of-reel routine. At this time, the trailer, if any, is in the IOTRSHLBL area.

Under Mode 2, when an end-of-reel condition is recognized, CSEOF will not transfer to the object program end-of-reel routine until all of the areas have been processed. This condition is determined by testing the force counter. (See "force counter" in the CSDTS section of this manual.) When all the areas have been processed, CSEOF transfers to

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the object program end-of-reel routine. At this time, the trailer, if any, is in the IOTRSHLBL area.

After the transfer to the object program end-of-reel routine, end-of-reel handling is the same for both modes. If return from the end-of-reel routine is to IORETURNTO, CSEOF will rewind or rewind-unload the reel, reset the tape record, file, skip, and redundancy counters to zero, and select the alternate reel which may be on any channel. If no alternate is specified, or if an alternate is specified and not found, a message is typed and IOCS will wait for another reel of tape to be mounted. At end of reel, processing of I/O areas may be continued as if the end-of-reel condition had not occurred. When all end-of-reel operations have been performed, a checkpoint is taken if specified in the file table and a separate checkpoint tape is indicated.

The number of data tape records processed is compared to the number of data tape records indicated in the trailer before CSEOF transfers to the End-of-Reel Transfer Address. If the counts are not equal, a message will indicate the respective counts. The object programmer has two options: to continue end-of-reel processing, or to restart from the last checkpoint.

OUTPUT TAPE

End of reel on an output tape is recognized when a reflective spot is sensed. It may be forced prematurely by the macro-instruction IOFER. In either case, the sequence of operations is the same. A standard end-of-reel trailer is created in the IOTRSHLBL area. If Mode 1 is specified, CSEOF transfers to the object program end-of-reel routine; if Mode 2 is specified, IOCS performs all operations which were requested on this file before transferring to the object program end-of-reel routine. If return is to IORETURNNO, CSEOF transfers to the object program. If return is to IORETURNTO, CSEOF writes a tape mark, a trailer, if desired, and another tape mark. A rewind or rewind-unload operation is executed as indicated in the file table, and the tape record, skip, file, and redundancy counters are reset to zero. The alternate is selected and a header is written, if specified in the file table. If there is no alternate specified or if none is found, a message is typed and IOCS will wait for another reel to be mounted. Checkpoint is taken if specified for end of reel. If checkpoint records are written at the beginning of an output reel, and alternate reels are on different channels, Mode 2 end-of-reel handling must be specified for this file.

End-of-File Procedures

SINGLE-FILE INPUT TAPE

When a tape mark has been read and CSEOF determines that an end-of-file condition exists, CSEOF checks the force counter to determine if all input areas have been processed before transferring to the object program end-of-file routine.

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CSEOF waits until this condition exists. When all areas have been pro-
cessed, CSEOF compares the number of records processed to the number
of tape records written on this tape. If they are not equal, a message
will be typed indicating the value of the respective counters. Two options
are given at this time: to continue normal end-of-file operations, or to
link to CSMRS to restart from the last checkpoint. If the counters are
equal, or if the option to continue with normal end-of-file processing is
taken, CSEOF transfers to the object program end-of-file routine. At
this time, the trailer has been read into the IOTRSHLBL area. If return
is to IORETURNTO, CSEOF will continue with end-of-file processing. If
nonsequential handling is specified, CSEOF positions the tape before the
first tape mark. If sequential handling is specified, the tape record, file,
error and skip counters in the file table are reset to zero. CSEOF will
rewind or rewind-unload the tape as indicated in the file table. When
end-of-file processing is complete, a checkpoint is taken if indicated for
end of file and if there is a separate checkpoint tape.

IOCLS - INPUT TAPE

The macro-instruction IOCLS indicates to CSEOF that the object pro-
grammer wishes to close a tape file. The tape record, noise, permanent
read error, file, and redundancy counters are reset to zero and the tape
is rewound or rewound and unloaded as specified in the file table.

MULTIFILE INPUT TAPE

When a tape mark is recognized and CSEOF determines that an end-of-file
condition exists on a multifile tape, before continuing with end-of-file
procedures, the force counter is tested to see that all areas have been
processed. When all areas have been processed, CSEOF compares the
number of records processed to the number of tape records indicated in
the label. If they are not equal, a message will be typed indicating the
value of the respective counters. Two options are given at this time: to
continue normal end-of-file operations, or to link to CSMRS to restart
from the last checkpoint. If the counters are equal, or if the option to
continue is chosen, CSEOF transfers to the object program header routine.

If return is to IORETURNTO and the tape is handled sequentially, the
next file on the tape is opened, the tape record counter is reset to zero,
the file counter is incremented by one, and the I/O areas are primed, if
priming is indicated in the file table. At end of file, the I/O areas are
initialized so that processing begins from the first area for the next file.

If return is to IORETURNTO and the tape is handled nonsequentially, the
tape is positioned before the first tape mark. Checkpoint is taken if
specified for end of file and if a separate checkpoint tape is indicated.

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IOCLS - OUTPUT TAPE

The macro-instruction IOCLS indicates to CSEOF that the object pro-
grammer wishes to close a tape file. A standard end-of-file trailer is
created in the IOTRSHLBL area and CSEOF transfers to the object program
end-of-file routine. Return must be to IORETURNTO. CSEOF will then
write a tape mark, an end-of-file trailer if desired, and another tape
mark. The tape record, skip, file, and error counters are reset to zero
for this file. CSEOF will then rewind or rewind and unload the tape as
indicated in the file table. Checkpoint is taken if specified for end of file
in the file table.

IOMFC - OUTPUT TAPE

The macro-instruction IOMFC indicates to CSEOF that the object program-
mer wishes to close a file on a multifile tape. A standard end-of-file
trailer is created in the IOTRSHLBL area and CSEOF transfers to the
object program end-of-file routine. Return must be to IORETURNTO.
CSEOF will then write a tape mark, trailer if desired, and another tape
mark, and position the tape before the first tape mark. CSEOF does not
check for sequential or nonsequential handling when the macro-instruction
IOMFC is given. The tape is always positioned after the last data tape
record. If the object programmer wishes to write another file on this
tape, he should use the macro-instruction IOMFO, which is explained
below. If the object programmer does not wish to write again on this reel,
the file is closed and macro-instructions IORWD or IORUN may be used
to rewind the tape. Checkpoint will be taken at end of file if indicated in
the file table.

IOMFO - OUTPUT TAPE

The macro-instruction IOMFO will terminate one file on a multifile output
tape and position the tape to receive records for the next file. A standard
intermediate header — which serves as a trailer to the preceding file and
a header to the file following it on the tape — is created in the IOTRSHLBL
area (See Figure 6). CSEOF will then write a tape mark, label if desired,
and another tape mark. The record counter is reset to zero and the file
counter is incremented by one. The I/O areas are initialized so that
writing begins from the first area for the next file.

End-of-File, End-of-Reel Messages

When an end-of-reel condition or an end-of-file condition occurs, an
indicative message may be typed, ignored, or placed on the secondary
output unit according to the Message Type Code. (See "Type Subroutine.")
These messages will include the record counter, skip counter, or noise
record counter, number of entries into the redundancy correction routine,
and the number of permanent redundancies.

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Counters Altered By CSEOF

	Tape Record Counter Setting	Noise or Skip Counter Setting	File Counter Setting	Redundancy Counter Setting	Permanent RD/WR Counter Setting	Last Noise Counter Setting
INPUT						
EOR	+000000	+00	+000	+00	+00	+000
IOCLS	"	"	"	"	"	"
EOF (single)	"	"	"	"	"	"
EOF (multi)	"	—	Incremented by 1	—	—	"
OUTPUT						
IOFER	+000000	+00	+000	+00	+00	+000
EOR	"	"	"	"	"	"
IOCLS	"	"	"	"	"	"
IOMFC	—	—	—	—	—	—
IOMFO	+000000	—	Incremented by 1	—	—	+000
INPUT OR OUTPUT						
IORWD	+000000	+00	+000	+00	+00	+000
IORUN	"	"	"	"	"	"

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CSERR - ERROR CORRECTION

Introduction

All input/output operations performed by IOCS are checked for error and end-of-file conditions. CSERR first checks for record length errors, and then tape or channel errors. If an error has occurred, an appropriate corrective procedure is executed. When no error has occurred, or when the corrective procedure has been completed, CSERR interrogates the I/O indicator and transfers to CSEOF if the indicator is on.

All tape records, including redundant tape records, are checked for length, if length checking is specified in the file table.

The error correction routines follow the recommendations of the engineering staff which designed the 729 II and IV tape drives and the 7080 channel controls, and comply with the Applied Programming tape handling standards.

General Correction Procedures

Record Length Errors

If a record length error occurs when reading a record CSERR first determines, in the case of a fixed-length record, if the computed length of the record exceeds the specified length by more than ten characters. In the case of variable-length records, CSERR determines if the computed length exceeds the specified maximum record length by more than ten characters. If so, a message is typed to indicate this error. The object programmer has two options: to attempt to reread or rewrite the record, or to restart from the last checkpoint. Caution should be observed in choosing to re-execute the operation, since a record which exceeds the specified length by more than ten characters may have destroyed a part of memory. If, however, the length error is less than ten characters, a check is made to see if the record was redundant. If a redundancy has occurred, CSERR follows the correction procedure outlined for a redundant record. If no redundancy has occurred, two attempts are made to re-execute the operation which resulted in the length error. If the length is still in error, message 30214/5 is typed, which gives the exact record length. The object programmer has two options: to re-execute the operation; or to proceed to message 30222/3. The options following 30222/3 are explained on the following pages. The buffer areas terminating the I/O areas are restored before each retry.

Redundancies

PCT CHECKS ON A READ

If a PCT check, or a combination of a PCT check and a length error occurs, CSERR determines if the record was a noise record or a redundant tape

mark. If not, nine successive attempts are made to read the record correctly. On each retry, a check is made for correct record length, if record length checking has been specified. After nine retries, if the record is still redundant, a tape cleaner routine is executed, unless the tape is less than three records from load point or a noise record has been detected in the past three records. After the tape cleaner routine has been executed, one more attempt is made to read the record. This routine (i.e., nine retries and tape cleaner routine) is executed nine more times if the redundancy persists. If the record is still redundant, it is a permanent read error and the record is searched for redundancies. When a redundancy is found, unless automatic dumping has been specified, the location and bit structure of this character is typed. CSERR next transfers to IOREDUNCHK. At this time, the character as corrected by CSERR ("C" bit reversed) and its location are in IOREDUNAD. If the object programmer accepts the IOCS-corrected character, he must return at IORETURNTO and the corrected character will replace the redundant character in memory. If he has replaced the redundant character with another character, he must return at IORETURNNO. When the entire area has been searched, if automatic dumping is specified, the record is dumped. If no redundancies were found, loop/message 30211 is executed. The console operator may take the option to re-execute the operation or the option to execute loop/message 30223. Following loop/message 30223, the console operator has the option of either dumping the record or accepting the record as it is in memory. If redundancies are found, loop/ message 30221 is executed. The console operator may take the option of re-executing the operation or of executing loop/message 30223. (The options of loop/message 30223 are explained above.)

PCT CHECKS ON A WRITE

When a PCT check, or a combination of a PCT check and a length error occurs on a write, a backspace is executed and an attempt is made to rewrite the record. The record length is checked on every retry, if length checking is specified in the file table. If the first attempt to re-write the record is unsuccessful, the tape is backspaced, a skip is executed and another attempt is made to write the record. The skip is executed four more times if the redundancy persists. If the record is still redundant, a search is executed to determine if there are any redundant characters in memory. When a redundancy is found, the location and bit structure of this character is typed. CSERR next transfers to IOREDUNCHK. At this time, the character, as corrected by CSERR ("C" bit reversed), and its location are in IOREDUNAD. If the object programmer accepts the IOCS-corrected character, he must return at IORETURNTO. If he has replaced the redundant character with another character, he must return at IORETURNNO. When the entire area is searched and no redundancies are found, the above sequence (i.e., five skips and a redundancy search) is repeated until a total of twenty-five skips have been performed in attempting to correct the redundancy. If no redundancies are found during the final redundancy search, loop/ message 30210 is executed. The console operator may take the option to re-execute the operation or the option to execute loop/message 30222.

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Following loop/message 30222, the console operator has the option of either restarting from the last checkpoint or accepting the record as it now appears on tape. If redundancies are found, loop/message 30220 is executed, where the console operator has the options of re-executing the operation, thus writing a corrected record on the tape, or restarting from the last checkpoint.

NOTE: If a record is both redundant and of incorrect length, and the 253 option is executed at loop/message 30210, 30211 or 30221, loop/message 30214 or 30215 will be executed before loop/message 30222 or 30223.

PCT CHECKS ON IOFSF, IOBSF, IOFSP OR IOPOS

When a PCT check occurs during a tape-positioning operation, a test is made to determine if the record just passed over was a noise record or a redundant tape mark. If the record was neither of these, the PCT is ignored, since it it assumed that this record is not to be used at present. If the record was a noise record or a redundant tape mark, loop/message 30213 or 30217, respectively, will be executed. (See "IOCS80 Waiting Loops and Messages" for available options.)

Automatic Dumping

This option gives the object programmer a means of dumping unreadable records automatically without the need for an operator decision.

Status Triggers

The condition of the status triggers will be indicated in the following situations:

1. Alteration Switch 916 is ON. (Loop/message 10213/4.)

2. A permanent RD/WR error has occurred. (Loop/messages 30210/1, 30220/1.)

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CSMRD - MEMORY RECORD

Purpose of CSMRD

The function of CSMRD is to record the status of the computer at specified points, called checkpoints, during a production run. The recorded status (memory record) includes the contents of memory, the contents of storage, the setting of the alteration switches, and the position of all tape drives connected through the 7080 channels. This memory record is created so that, if necessary, the restart program (CSMRS) can subsequently re-establish the machine and program to the same status it was in when the memory record was written.

CSMRD and CSMRS make it possible to:

1. Terminate the processing of a program at a point of partial completion, and subsequently continue the program from this intermediate point.

2. Resume processing from an intermediate point rather than from the beginning of a job when an impassable error occurs.

Tape Requirements

Checkpoint records may be placed on a special tape which contains only checkpoint records, or at the beginning of an output reel (alternate reels must be on the same channel).

1. When checkpoint records are placed on a special tape, the recording of memory may automatically occur at either of the following points in a program (based on parameters given in the file tables):

    a. Any input or output end of reel.

    b. Any input or output end of file.

    In addition, memory may be recorded at any time desired through use of the macro-instruction IOLNK to CSMRD.

2. If checkpoint records are to be placed at the beginning of an output reel, the recording of memory may occur only at the beginning of a single specified file. Memory may not be recorded at any other time. (IOLNK to CSMRD may not be used.)

Memory Requirements

CSMRD requires the temporary use of the final 1025 positions of memory in order to record the contents of the storage banks. If the object program

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uses these positions, it may specify any output file as the checkpoint work tape (see IOTS macro-instruction). In this case, the 1025 memory positions are recorded on the work tape during the recording of memory. At the conclusion of the checkpoint routine, the 1025 memory positions are restored from the work tape and the tape is repositioned so that, as far as the object program is concerned, the work tape was unused during the recording.

If no work tape is specified, it will be assumed that the 1025 memory positions may be used destructively.

TYPE SUBROUTINE

The type subroutine is included in the preassembled IOCS, and will accept functional linkages from either IOCS or the object program. Typing requirements of the object program should be satisfied through the IOCS type subroutine to avoid conflicting messages and options at the console. Messages may be typed or placed on a secondary output unit according to a Message Type Code which is specified in the linkage. The precise handling of particular message types is determined from switches contained in the IOCS control word.

Message Type Code

Messages may be split into four categories, Type A, B, C, or D.

Type A messages must be typed. All messages which require decisions or action from the console will be typed.

Type B messages will include all informative messages such as end of reel, end of file, and header label messages. The output of Type B messages will be dependent upon the control word indicator and on whether or not the associated file is a work tape. If the control word indicates that these messages are to be ignored, they will be ignored. If Type B messages are to be typed, messages which pertain to non-work tapes (see IOFTA operand X8) will be typed. If the associated file is a work tape, the message will be ignored. Type B messages may be placed on a secondary output unit (tape). In this case, all of the above statements are true, but pertain to the secondary output rather than the typewriter.

Types B, C, and D may be set up for a secondary output unit, or may be ignored altogether, according to the needs of the object program.

All IOCS messages will be originally set up as Type A and Type B messages, but may be changed by the IODCH macro-instruction.

For messages typed from the object program, the Message Type Code will be one of the operands of the IOTYP or IODEC macro-instructions. Any of the four types may be specified. However, if a decision is required, the message should be put on the typewriter to inform the console operator that a waiting loop has been entered.

Changing Message Type Codes

The macro-instruction IODCH may be used to change the Message Type Code of any message.

Any of twelve possible Message Type Codes may be specified for a decision message, and any of four Message Type Codes for a type message. The Message Type Codes are as follows:

1.   To designate the handling of messages which do not involve a decision, or for which no option is specified.

     a.   A or Ab — Message must be typed.

     b.   B, Bb, C, Cb, D or Db — These types may be typed, placed on a secondary output unit, or ignored, according to the control word designation.

2.   To designate a Message Type Code and specify the execution of Option 2 (252) without entering a waiting loop: A2, B2, C2 or D2.

3.   To designate a Message Type Code and specify the execution of Option 3 (253) without entering a waiting loop: A3, B3, C3 or D3.

Thus, a message which was originally typed may be changed to be put on a secondary output unit or ignored altogether, and a decision message for which the option may be decided in advance may be altered to avoid entering a loop to wait for a decision from the console.

IOCS messages will originally be set up as Type A and Type B messages with no options specified. However, a list of tags to be used with the IODCH macro-instruction is provided at the end of this section so that they may be changed according to the needs of an installation or a particular program. These tags are included in subroutine CSAB, which is automatically included in the object program if an IODCH macro is coded referencing one of these tags.

Setup of Control Word

The four-character control word will originally be set up to put all messages on the typewriter. If a secondary output unit is used, or some Message Type is to be ignored, the control word must be changed before entering CSHSK. To change from one type to another, the SBN and SBZ instructions will be used. The control word may be changed as follows:

1.   To put Type B messages on tape:

          SBZ   1   CSW091

2.   To ignore Type B messages:

          SBZ   1   CSW091
          SBZ   2   CSW092

3.   To put Type C messages on tape:

          SBZ   1   CSW101

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4. To ignore Type C messages:

        SBZ   1   CSW101
        SBZ   2   CSW102

5. To put Type D messages on tape:

        SBZ   1   CSW111

6. To ignore Type D messages:

        SBZ   1   CSW111
        SBZ   2   CSW112

Secondary Output Unit

A new feature permits the placement of messages on tape instead of the typewriter, to save much of the time required for messages which are not needed at the console.

In the preassembled IOCS, the only secondary output unit which may be used is tape. The tape to be used is designated during the assembly of the object program in operands X7 and X8 of the IOTS macro-instruction.

The control word is set up to specify the output unit to be used for each of the Message Types (A, B, C, D), or a particular Message Type may be ignored altogether. (This may be desired for Type D messages.) Type A messages must be put on the typewriter, but Types B, C and D may be specified by the object program. (If these types are not specified by the object program, all messages will be typed.)

Message Setup

All messages must be terminated by a group mark. If messages are always typed, they may be set up in any position desired or as literal operands in the macros. However, if a secondary output unit is used, any messages which may be put on it must start in a 1 or 6 position and must be preceded by a blank in the 0/5 location.

Example 1

Messages that can be assigned to a secondary output unit (tape):

TAG	OPERATION	NUM	OPERAND
	NAME	0	
	CON	01	
TAG A	CON	XX	MESSAGE

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Messages which were set up for 705 III IOCS need not be changed, but
they will be assigned to Type A and will be written on the typewriter.

Example 2

TAG	OPERATION	NUM	OPERAND
	IOTYP		MESSAGE ⨅

The message can be set up in any position desired, and the macro-
instruction will be assigned to Type A.   Thus, the macro-instructions
used with 705 III IOCS may be used unchanged, but the message can
only be typed or bypassed.

Two Option Decisions

Two option decisions will be set up by using Interrupt Keys 252 and 253.
These options will be referred to as Option 2 for Interrupt Key 252 and
Option 3 for Interrupt Key 253.

For decision messages with only one option, Option 2 should always be
used.   For messages with two options, Option 2 will be the normal return.

Decision messages will be set up to go into a two-instruction loop to await
a decision from the console.   For messages from the object program and
from IOCS, a NOP-TR loop will be executed.

Decision messages from the object program should be clearly indicated to
the machine operator to avoid unnecessary waiting in the loop.

Decision messages from IOCS will be set up with a five-position message
code, of which the first two digits will be either 00, 20 or 30.

Another new feature will be the ability to permanently specify options for
particular decision messages from IOCS before running the program.
This will be set up as zoning over the Message Type Code.   This may be
done on any one- or two-option message for which action from the console
is not needed, and for which the option for the message can be decided in
advance.   If an action is specified in advance, the Message Type Code
may also be changed to permit the message to go on the secondary output
unit or to be ignored altogether.   These options may be indicated through
the macro-instruction IODCH.

This step will allow the object programmer to eliminate unnecessary
waiting for IOCS decisions if the option to be taken can be decided in
advance.

Any programmer using IOCS who desires to use Interrupt Keys 252 and 253 to permit operator decisions should use the IODEC macro-instruction for this purpose rather than an object program routine. Otherwise, it is possible that, after having typed a message and while waiting for an operator decision, a channel may interrupt to IOCS. This interruption may produce a situation also requiring operator intervention. At this point, IOCS will modify Interrupt Words 252 and 253 and type a message, thus facing the operator with two messages requiring decisions. This condition will cause some confusion as to what will result from the depression of one of the Interrupt Keys. Furthermore, even if the programmer is willing to run this risk, he must be very careful in coding any instructions which affect Banks 2 and 3 of central storage.

Consider the following example:

TAG	OPERATION	NUM	OPERAND
	TIP		TAG A
	NOP		
	TR		*-5
	.		
	.		
	.		
TAG A	SPC		2520
	LFC		R@W252
	SPC		2530
	LFC		R@W253
	LIP		9
W252	SPC		3700
	LFC		R@OP A
	LIP		9
W253	SPC		3700
	LFC		R@OP B
	LIP		9

The above sequence will not work properly, since it is possible that between the first LIP 9 and the manual interrupt to Word 252 there will have been a channel interrupt to an IOCS routine which may have modified CASU 15 to LIP to a loop to wait for an operation to be completed. Remodification of CASU 15 at this point could cause major difficulties. A more satisfactory routine would be the following:

TAG	OPERATION	NUM	OPERAND	COMMENTS
	TIP		TAG B	
	RCVS		SW	
	TZB	1	*-5	
	TZB	2	OP A	

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TAG	OPERATION	NUM	OPERAND	COMMENTS
	TR		OP B	
	.			
	.			
	.			
	.			
TAG B	SPC		2520	
	LFC		R@W252	
	SPC		2530	
	LFC		R@W253	
	SBZ	1	SW	
	LIP		9	
W252	SBN	1	SW	
	SBZ	2	SW	
	LIP		9	
W253	SBN	1	SW	
	SBN	2	SW	
	LIP		9	
SW	BITCD	1		Loop Control
		2		Option Control

NOTE: All of this may be replaced by simply coding the following:

OPERATION	NUM	OPERAND
IODEC		MESSAGE ¤ OP B ¤
TR		OP A

CSAB — Loop/Message Tags

This subroutine includes the tags of the IOCS80 loops and messages to which the object programmer may refer when using the IODCH macro-instruction to modify IOCS80 messages.

The loop/message tags and fields are defined as follows:

Tag	Size of Field	Loop/Message Number(s)
CSM00226	20 positions	00226, 00227
CSM00250	13 positions	00250
CSM00252	17 positions	00252, 00253
CSM00254	20 positions	00254

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Tag	Size of Field	Loop/Message Number(s)
CSM10212	8 positions	10212, 10213
CSM10230	11 positions	10230, 10231, 20230, 20231
CSM10232	20 positions	10232, 10233
CSM10240	12 positions	10240
CSM10283	20 positions	10283
CSM10291	7 positions	10291
CSM20211	18 positions	20211, 20212
CSM20226	16 positions	20226, 20227
CSM20260	17 positions	20260
CSM20280	15 positions	20280, 20281
CSM30210	20 positions	30210, 30211
CSM30213	13 positions	30213, 30217
CSM30214	20 positions	30214, 30215, 30218, 30219
CSM30220	15 positions	30220, 30221
CSM30222	13 positions	30222, 30223
CSM30224	8 positions	30224, 30225
CSM30227	20 positions	30227
CSM30241	14 positions	30241
CSM30282	15 positions	30282, 30283
CSM30290	7 positions	30290, 30291
CSM30293	7 positions	30293
CSM30295	7 positions	30295
CSM30296	7 positions	30296, 30298, 30299
CSM10299	1 position	10299
CSM10298	1 position	10298

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Tag	Size of Field	Loop/Message Number(s)
CSM00259	14 positions	00259
CSM10211	18 positions	10211
CSM10271	19 positions	10271
CSM10273	20 positions	10273
CSM10275	19 positions	10275
CSM10280	15 positions	10280, 10281
CSM10284	17 positions	10284, 10285
CSM10288	19 positions	10288
CSM10289	11 positions	10289
CSM20271	12 positions	20271
CSM20273	14 positions	20273
CSM20275	16 positions	20275
CSM20282	19 positions	20282
CSM30271	10 positions	30271
CSM30273	10 positions	30273
CSM30280	9 positions	30280

IOCS80 WAITING LOOPS AND MESSAGES

The Standardized System

To simplify the operation of IBM programs and programming systems, a standardized Waiting Loop/Message system has been developed for use in IOCS and other programs. This system includes the following standards:

1. All waiting loops must be accompanied by a message, numbered according to the established standards.

2. Numbering of messages without waiting loops is left to the programmer's discretion. If numbered, the message must conform to the established standards.

3. A five-digit Identification Code, which is the loop/message number and must be the same as the address of the loop/message, must be set up in the format outlined below:

    a. Ten-Thousands Position: The digit in this position indicates the condition that exists at the time the loop/message occurs. It also specifies the linkages which follow.

        0   indicates a "cannot-proceed" condition, or dead end loop. Both a loop and message occur, and continuation of the program is not advised. The loop is always followed by an unconditional transfer back to itself, so that the program will not continue if either Interrupt Key 252 or 253 is depressed.

        1   indicates that a routine of particular significance has been executed, and is used only when no operator action is required. In IOCS, the message is not accompanied by a waiting loop, and the next routine is entered automatically after the message is written.

        2   indicates an "await-action" condition, and both a loop and message occur. It is used when a single course of action, such as correcting a control card, must be followed by the programmer in order to continue the program. Of course, the operator also has the option of terminating the program. The action for continuation is given in the list of loops and messages. The programmed loop in an "await-action" condition is always followed by linkage to the routine to be executed next. Although the loop/message section in most cases only mentions depressing Interrupt Key 252 to execute this linkage, depressing Interrupt Key 253 will give the same result.

3   indicates an "await-decision" condition, and both a loop and message occur. It is used when alternate courses of action to continue the program are available, and the operator must make a decision between them. One option is executed by depressing Interrupt Key 252; the other by depressing Interrupt Key 253. The operator may also terminate the program.

b.   Thousands Position: The digit in the thousands position indicates the phase or section of the program with which the loop and/or message is associated. The digit zero is used by IOCS, as well as all other generalized routines developed by IBM.

c.   Hundreds Position: The digit in the hundreds position is used to designate the specific programming system involved. The digit "2" is used to specify IOCS. Other designations currently in use are "4" for Utility Programs and "7" for Processor.

d.   Tens and Units Positions: These positions are assigned by the project itself, and contain an arbitrarily assigned number which differentiates various loops and/or messages which start with the same three digits. An odd number indicates an input unit is involved; an even number indicates an output unit is involved.

IOCS Message Type Codes

All IOCS messages are originally set up as Type A and Type B messages, as indicated under the column headed "Type" on the following pages. However, they may be changed as indicated in the description of Message Type Codes in the previous section, "Type Subroutine."

Cannot-Proceed Loops and Messages

Type	Identification Code	Message, Explanation, Action
A	00226	00226-xy-I/O AREA zzzzzz

Explanation: A linkage has been given to IOCS80 to execute a write operation on tape 2x0y from an output area whose address does not end in 0 or 5. zzzzzz is the location of the output area.

Action: Obtain a memory printout.

Type	Identification Code	Message, Explanation, Action
A	00227	00227-xy-I/O AREA zzzzzz

Explanation: A linkage has been given to IOCS80 to execute a read operation from tape 2x0y into an input area whose address does not end in 0 or 5. zzzzzz is the location of the input area.

Action: Obtain a memory printout.

Type	Identification Code	Message, Explanation, Action
A	00250	00250

Explanation: A linkage which calls for a special operation has been made from the object program to IOCS; the subroutine necessary to perform the special operation is not included with the object program or IOCS.

Action: Obtain a memory printout. The address of the improper linkage is located in CSD0099.

Type	Identification Code	Message, Explanation, Action
A	00252	00252-xy-IMPROPER OP

Explanation: A linkage which calls for a read operation on output tape 2x0y has been made from the object program to IOCS.

Action: Obtain a memory printout.

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Cannot-Proceed Loops and Messages (Cont'd)

Type	Identification Code	Message, Explanation, Action
A	00253	00253-xy-IMPROPER OP Explanation: A linkage which calls for a write operation on input tape 2x0y has been made from the object program to IOCS. Action: Obtain a memory printout.
A	00254	00254-IMPLNK @ zzzzzz Explanation: An improper linkage has been given to IOCS80 at location zzzzzz. Action: Obtain a memory printout.
A	00259	00259-TT ERROR Explanation: The Tape Table specifies a file table address which does not end in 4 or 9; or no file table is located at a specified address. This loop/message will be preceded by either 10288-xy-INCOR FT ADDR or 10289-xy-NO FT. Action: Obtain a memory printout, and examine the Tape Table for errors.
A	00260	00260-DISCONTINUE Explanation: Interrupt Key 253 has been depressed following loop/message 30260 indicating a desire to temporarily discontinue the program. All tapes have been rewound. Action: Dismount all tapes used by the object program, labeling them carefully so that the program may be restarted correctly.
A	00265	00265-xy-TM TROUBLE Explanation: A restart has just been completed and it has been found that no tape mark follows the checkpoint file, indicating that the checkpoint tape is improperly positioned. Action: Try restarting again, from a previous checkpoint if desired.

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Successful Completion Messages

Type	Identification Code	Message and Explanation
A	10210	10210-xx yy Explanation: This message is typed at the beginning of a run for identification purposes. xx is the assembly number; yy indicates the number of patches included.
A	10211	10211-aaaaaa xxyyy Explanation: This message specifies the program name and the current date specified on the first control card. aaaaaa is the program name; xx specifies the year, and yyy indicates the calendar day.
A	10212	10212-xy-st Explanation: Alteration Switch 916 is ON, and the error correction routine has been entered to correct an error which has occurred on output tape 2x0y. The condition of the Status Triggers is indicated by st.
A	10213	10213-xy-st Explanation: Alteration Switch 916 is ON, and the error correction routine has been entered to correct an error which has occurred on input tape 2x0y. The condition of the Status Triggers is indicated by st.

Type	Identification Code	Message and Explanation
B	10230	10230-xy-F, nnn

Explanation: File nnn of output tape 2x0y has been closed.

OR

10230-xy-R, nnn

Explanation: An end of reel has occurred on output tape 2x0y, and the next alternate tape for the file is now being used. The completed reel is reel number nnn of the output file.

OR

10230-xy-C, nnn

Explanation: An IORWD or IORUN has been executed on output tape 2x0y. The file count is nnn.

Type	Identification Code	Message and Explanation
B	10231	10231-xy-F, nnn

Explanation: An end of file has occurred on file nnn of input tape 2x0y.

OR

10231-xy-R, nnn

Explanation: An end of reel has occurred on input tape 2x0y, and the next alternate tape for the file is now being used. The completed reel is reel number nnn of the input file.

OR

10231-xy-C, nnn

Explanation: An IORWD, IORUN or IOCLS operation has been executed on input tape 2x0y. The file count is nnn.

Type	Identification Code	Message and Explanation
B	10232	10232-xy-zzzzzz rr ss ee

Explanation: This message follows message 10230, and contains error statistics for output tape reel 2x0y. rr redundancies, ss skips and ee permanent write errors have occurred on this reel. The tape record counter is zzzzzz.

Type	Identification Code	Message and Explanation
B	10233	10233-xy-zzzzzz rr nn ee

Explanation: This message follows message 10231, and contains error statisitics for input tape reel 2x0y. rr redundancies, nn noise records and ee permanent read errors have occurred on this reel. The tape record counter is zzzzzz.

| A | 10240 | 10240-xy-zzzzzz |

Explanation: Checkpoint number zzzzzz is being taken on output tape 2x0y.

| A | 10271 | 10271-FT,aaaaaaaaaa |

Explanation: A control card with file identification aaaaaaaaaa has been read. No file table with this file identification was found. The label control card has been ignored.

| A | 10273 | 10273-CYC CK NONUM |

Explanation: Cycle checking was indicated in the file table, but the three high-order positions of the file identification are non-numeric; therefore, the control card has been ignored.

| A | 10275 | 10275-CC, aaaaaaaaaa |

Explanation: No control card has been found for the input file with file identification aaaaaaaaaa. This message will be followed by loop/message 20275.

Type	Identification Code	Message and Explanation
A	10280	10280-xy-NOT READY Explanation: Output tape 2x0y is not Ready. This message will be followed by loop/ message 20282-CK NON RDY TAPES.
A	10281	10281-xy-NOT READY Explanation: Input tape 2x0y is not Ready. This message will be followed by loop/ message 20282-TPS NOT READY.
A	10284	10284-xy-NEW ALT TOT Explanation: The file table alternate total field for output base tape 2x0y has been modified to specify the same number of alternate tapes as the Tape Table. All associated alternate tapes specified in the Tape Table will be listed below the message in the following format: -xy-#n, ab where 2x0y is the base tape, n is the alternate sequence number, and 2a0b is the alternate tape.
A	10285	10285-xy-NEW ALT TOT Explanation: The file table alternate total field for input base tape 2x0y has been modified to specify the same number of alternate tapes as the Tape Table. All associated alternate tapes specified in the Tape Table will be listed below the message in the following format: -xy-#n, ab where 2x0y is the base tape, n is the alternate sequence number, and 2a0b is the alternate tape.

Type	Identification Code	Message and Explanation
A	10288	10288-xy-INCOR FT ADDR Explanation: The base tape entry for tape 2x0y in the Tape Table specifies an address which does not end in 4 or 9. This message will be followed by loop/message 00259.
A	10289	10289-xy-NO FT Explanation: No file table has been found at the address specified in the base tape entry for tape 2x0y in the Tape Table. This message will be followed by loop/message 00259.
A	10291	10291-xy-L Explanation: The file table label type indicator specifies that a tape mark should follow the header. No tape mark follows the header on input tape 2x0y. The record following the header will be treated as a data record, and processing will continue.
A	10298	xxxx/xxxx-xxx xxxxxxxxx xxxxx-xxx 10298-xy-L Explanation: A standard header has been created for the first file of output tape 2x0y. A portion of the header has been typed as the first line of this message.
A	10299	xxxx/xxxx-xxx xxxxxxxxx xxxxx-xxx 10299-xy-L Explanation: A standard header has been read for the first file of input tape 2x0y. A portion of the header has been typed as the first line of this message.

Type	Identification Code	Message, Explanation, Action
A	20211	20211-xy-FILE NOT FND

Explanation: A "search file" operation with a file identification routine has been performed on input tape 2x0y. The entire tape has been searched and the correct file has not been found.

Action: Depress Interrupt Key 252 to search the current reel or a newly mounted reel on tape unit 2x0y.

Type	Identification Code	Message, Explanation, Action
A	20226	20226-xy-PCT ON RMA

OR

no message

Explanation: A PCT check has occurred during the execution of ε RD 02 which was initiated to turn off the error triggers. Output tape 2x0y was selected.

Action: 1. If machine is in manual status, depress START to repeat the RMA.
2. If machine is in AUTOMATIC, depress Interrupt Key 252 to repeat the RMA.

Type	Identification Code	Message, Explanation, Action
A	20227	20227-xy-PCT ON RMA

Explanation: A PCT check has occurred during the execution of a RD 02 which was initiated to turn off the error triggers. Input tape 2x0y was selected.

Action: Depress Interrupt Key 252 to repeat the RMA.

Type	Identification Code	Message, Explanation, Action
A	20230	20230-xy-R, nnn

Explanation: An end of reel has occurred on output tape 2x0y which was reel nnn of the file. No alternate has been specified.

Action: Mount a new tape on 2x0y, then depress Interrupt Key 252 to resume processing.

Type	Identification Code	Message, Explanation, Action
A	20231	20231-xy-R, nnn

Explanation: An end of reel has occurred on input tape 2x0y which was reel nnn of the file. No alternate has been specified.

Action: Mount a new tape on 2x0y, then depress Interrupt Key 252 to resume processing.

Type	Identification Code	Message, Explanation, Action
A	20271	20271-902-CC

Explanation: A 902 error occurred while trying to read a label control card from the card reader.

Action: Correct the control card which caused the error and replace it in the card reader; then depress Interrupt Key 252 to reread the card.

Type	Identification Code	Message, Explanation, Action
A	20273	20273-INCOR CC

Explanation: The date control card is incorrect; or, if the control cards are on tape, a record other than 80 characters in length was encountered.

Action: 1. If the date card is incorrect, replace it with a correct card in the card reader; then depress Interrupt Key 252 to reread the card.
2. If the control cards are on tape and any more control cards are to be read, place them in the card reader; then depress Interrupt Key 252.

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Type	Identification Code	Message, Explanation, Action
A	20275	20275-SUPPLY CCS

Explanation: One or more input files have no standard header control card. This loop/message is preceded by message 10275, which lists the file identification(s) of the file table(s) requiring a control card.

Action: Load the card reader with the missing standard header control card, followed by an END card; then depress Interrupt Key 252 to read the card(s) from the card reader.

| A | 20280 | 20280-xy-NOT READY |

Explanation: Output tape 2x0y is not Ready.

Action: Get the tape Ready. Depress Interrupt Key 252 to recheck the Ready status of this tape.

| A | 20281 | 20281-xy-NOT READY |

Explanation: Input tape 2x0y is not Ready.

Action: Get the tape Ready. Depress Interrupt Key 252 to recheck the Ready status of this tape.

| A | 20282 | 20282-TPS NOT READY |

Explanation: A loop in CSHSK, which waits for all tapes to become Ready, has been executed. Prior to this loop/message, the non-ready tapes have been listed. (See messages 10280, 10281.)

Action: Get the specified tapes Ready. Depress Interrupt Key 252 to recheck all tapes.

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Type	Identification Code	Message, Explanation, Action
A	30210	30210-xy-r, aaa zzzzzz st

Explanation: The standard number of skips (25)
has been executed in attempting to correct a
redundancy in writing on tape 2x0y from the
output area at location zzzzzz, and the record
is still redundant. r identifies the routine (1)
which is attempting to execute operation aaa;
st indicates the condition of the Status Triggers.
The output area has been checked for redun-
dancies, but none were found. CSERR will
not execute any skips beyond the reflective
spot at end of reel; it will only backspace
and rewrite.

Action: 1. To re-execute the operation, depress
Interrupt Key 252.

2. To reach loop/message 30222 (or 30214),
depress Interrupt Key 253. (See note
following "PCT Checks on a Write," in
the "CSERR-Error Correction" section
of this manual.)

Type	Identification Code	Message, Explanation, Action
A	30211	30211-xy-r, aaa zzzzzz st

Explanation: 100 attempts have been made to read
a record from input tape 2x0y into an input area
at location zzzzzz. The tape cleaner routine
has been executed, if applicable. (See CSERR-
Read Redundancies.) The input area has been
searched for redundancies, but none were found.
r identifies the routine (1) which is attempting
to execute operation aaa; st indicates the con-
dition of the Status Triggers.

Action: 1. To re-execute the operation, depress
Interrupt Key 252.

2. To reach loop/message 30223 (or 30215),
depress Interrupt Key 253. (See note
following "PCT Checks on a Write," in
the CSERR-Error Correction" section of
this manual.

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(1)   r is either "C", "L", or blank.
"C" indicates this operation was requested by CSMRD.
"L" indicates this operation was requested by CSTRS.
blank indicates this operation was requested by the object program.

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	Identification	
Type	Code	Message, Explanation, Action
A	30213	30213-xy- zzzzzz

Explanation: A noise record (1) has been detected
in reading from tape 2x0y. zzzzzz is the
address of the input area in use.

OR

30213-xy-FSP

Explanation: A noise record (1) has been detected
in forward spacing tape 2x0y.

Action: 1. To ignore this noise record and continue
with normal processing, depress Interrupt
Key 252.
2. To reread this record, depress Interrupt
Key 253.

---

(1) A noise record is a non-data pulse which is picked up by the read heads and
causes a PCT check. (Non-data pulses may be caused by line noises from
the tape unit, by foreign particles or improper coating on the tape, by creases
or tears in the tape, etc.). Since it is estimated that a noise record will
not exceed nine characters, IOERR assumes that a noise record has been
read if the calculated length is less than ten characters and causes a PCT
check.

After reading a record from tape, the tape is positioned a short distance
beyond the last character read.

After reading a noise record, therefore, the tape will normally be positioned
between the noise record and the next tape record which was to be read. The
tape may also be positioned at a point within that tape record, or in rare
instances, completely beyond it). The position depends upon the character
density of the tape and the "first-character pickup" gating of the channel,
as well as the relative position and size of the noise record and the tape
records which precede and follow it.

According to the particular position of the tape after reading a noise record,
depressing Interrupt Key 252 after Halt 30213 can result in any one of the
following:

1. Correctly reading the next tape record.
2. A PCT when reading the tape record.
3. Bypassing the record and reading the following records.

Depressing Interrupt Key 253 can result in any one of the following:

1. Correctly reading the record which follows the noise record.
2. Rereading the noise record.
3. Rereading the record which precedes the noise record.

The operator should be aware of these possibilities in choosing an option.

	Identification	
Type	Code	Message, Explanation, Action
A	30214	30214-xy-zzzzzz nnnnnn

Explanation: A record length error has occurred in writing on output tape 2x0y. A total of three attempts have been made to write this record correctly. The output area is at location zzzzzz, and the exact length of the record written is nnnnnn.

Action: 1. To re-execute the operation, depress Interrupt Key 252.

2. To reach loop/message 30222, depress Interrupt Key 253.

| | | |
| A | 30215 | 30215-xy-zzzzzz nnnnnn |

Explanation: A record length error has occurred in reading from input tape 2x0y. A total of three attempts have been made to read this record correctly. The input area is at location zzzzzz, and the exact length of the record read is nnnnnn.

Action: 1. To re-execute the operation, depress Interrupt Key 252.

2. To reach loop/message 30223, depress Interrupt Key 253.

Type	Identification Code	Message, Explanation, Action
A	30217	30217-xy-zzzzzz

Explanation: A redundant tape mark (1) has been encountered in reading from tape 2x0y into the input area at location zzzzzz.

OR

30217-xy-FSP

Explanation: A redundant tape mark (1) has been encountered in forward spacing tape 2x0y.

Action: 1. To effect a transfer to the end-of-file routine, depress Interrupt Key 252.
2. To reread this record, depress Interrupt Key 253.

---

(1) A redundant tape mark is a noise record of less than three characters in length which turns on both the PCT indicator and the tape unit I/O indicator. (The I/O indicator is turned ON whenever a one-character or a two-character record contains a character which has the 8421 bit structure of a tape mark.)

According to the particular position of the tape after reading a noise record, depressing Interrupt Key 253 after loop/message 30217 can result in:

1. Correctly reading the record which follows the noise record.
2. Rereading the noise record.
3. Rereading the record which precedes the noise record.

The operator should be aware of these possibilities in choosing an option.

Type	Identification Code	Message, Explanation, Action
A	30219	30219-xy-zzzzzz nnnnnn

Explanation: A read operation has been executed from input tape 2x0y into the input area at location zzzzzz. The calculated record length is nnnnnn. This calculated length exceeds the input area by 11 or more characters, and has therefore destroyed the buffer following it.

Action: 1. To restart from the last checkpoint, depress Interrupt Key 252.

2. To re-execute the read operation, (1) depress Interrupt Key 253.

| A | 30220 | zzzzzz-CBA8421 |

.

.

.

30220-xy-r aaa st

Explanation: Five consecutive skips have been executed on output tape 2x0y. The output area has been searched for redundancies, and the redundant characters are listed prior to this message. r indicates the routine (2) attempting to execute operation aaa. zzzzzz is the location of the redundant character, and the structure (bit configuration) follows. When this message occurs, these characters have been corrected by IOCS80 ("C" bit reversed) or replaced by the object program and are now valid characters in memory. st indicates the condition of the Status Trigger.

Action: 1. To re-execute the operation, depress Interrupt Key 252.

2. To restart from the last checkpoint, depress Interrupt Key 253.

---

(1) Extreme caution should be taken in re-executing this read operation. As noted above, a portion of memory required by the programmer may have been destroyed by this length error.

(2) r is either "C", "L", or blank.
"C" indicates this operation was requested by CSMRD.
"L" indicates this operation was requested by CSTRS.
blank indicates this operation was requested by the object program.

Type	Identification Code	Message, Explanation, Action
A	30221	zzzzzz-CBA8421

.

.

.

30221-xy-r aaa st

Explanation: 100 attempts have been made to read a record from input tape 2x0y. The input area has been searched for redundancies, and the redundant characters are listed prior to this message. r indicates the routine (1) attempting to execute operation aaa. zzzzzz is the location of the redundant character, and the structure (bit configuration) follows. When this message occurs, these characters have been corrected by IOCS80 ("C" bit reversed) or replaced by the object program and are now valid characters in memory.

Action: 1. To re-execute the operation, depress Interrupt Key 252.
2. To reach loop/message 30223 (or 30215), depress Interrupt Key 253. (See note following "PCT Checks on a Write," in the "CSERR-Error Correction" section of this manual.)

Type	Identification Code	Message, Explanation, Action
A	30222	30222-xy-zzzzzz

Explanation: This loop/message occurs when Interrupt Key 253 is depressed following loop/message 30210 or 30214. Twenty-five skips on tape 2x0y have been executed and a PCT error persists. The output area beginning at zzzzzz has been searched for redundancies, and none were found.

Action: 1. To restart from the last checkpoint, depress Interrupt Key 252.
2. To accept the record as written on tape and continue processing, depress Interrupt Key 253.

---

(1) r is either "C", "L", or blank.
"C" indicates this operation was requested by CSMRD.
"L" indicates this operation was requested by CSTRS.
blank indicates this operation was requested by the object program.

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	Identification	
Type	Code	Message, Explanation, Action
A	30223	30223-xy-zzzzzz

Explanation: This loop/message occurs when
Interrupt Key 253 is depressed following
loop/message 30211, 30215, or 30221. 100
attempts have been made to read this record
from tape 2x0y, and a PCT error persists.
The input area beginning at location zzzzzz has
been searched for redundancies and either
none were found or they were found and
corrected.

Action: 1. To dump this record, depress
Interrupt Key 252.

2. To accept the record as it has been
read, and continue processing, depress
Interrupt Key 253.

| | | |
| A | 30224 | 30224-xy-zz |

Explanation: The redundancy routine has been
entered a total of zz times for output reel
2x0y. The possibility of tape drive failure
should be considered in choosing an option
at this time.

Action: 1. To continue processing, depress
Interrupt Key 252.

2. To restart from the last checkpoint,
depress Interrupt Key 253.

| | | |
| A | 30225 | 30225-xy-zz |

Explanation: The redundancy routine has been
entered a total of zz times for input reel
2x0y. The possibility of tape drive failure
should be considered in choosing an option
at this time.

Action: 1. To continue processing, depress
Interrupt Key 252.

2. To restart from the last checkpoint,
depress Interrupt Key 253.

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Type	Identification Code	Message, Explanation, Action
A	30227	30227-xy-zzzzzz yyyyyy

Explanation: The tape record count in the file table does not equal the tape record count in the label on input tape 2x0y. The value of the label tape record count is zzzzzz and the value of the file table tape record count is yyyyyy.

Action: 1. To continue processing, depress Interrupt Key 252.
2. To restart from the last checkpoint, depress Interrupt Key 253.

A 30241

30241-xy-BSP FAIL

Explanation: Part of memory has been dumped from the end of an octant to checkpoint work tape 2x0y to allow taking of a checkpoint record. In attempting to read this record back into the end of the octant, CSMRD has found that SMAC does not end in 0000, and thus that memory has not been properly restored.

Action: 1. To attempt another read into the end of the octant, depress Interrupt Key 252.
2. To restart from the last checkpoint, depress Interrupt Key 253.

A 30260

30260-DISCONTINUE

Explanation: A checkpoint has just been completed. Alteration Switch 916 is ON, indicating that the program is to be temporarily discontinued.

Action: 1. If the program is to be temporarily discontinued, depress Interrupt Key 253 to rewind all tapes. Message 00260 will then be executed.
2. To continue processing, depress Interrupt Key 252. If this loop/message is not desired after every checkpoint, Alteration Switch 916 should be turned OFF.

	Identification	
Type	Code	Message, Explanation, Action
A	30271	30271-F, CC

Explanation: An end of file has occurred reading
standard header control cards from the card
reader. The cards should be terminated by
an END control card.

Action: 1. If more control cards are to be read,
place them in the card reader, followed
by an END control card, and depress
Interrupt Key 252.

2. If no more control cards are to be
read, depress Interrupt Key 253. The
program will proceed as though an
END card had been read.

| A | 30273 | 30273-xy-F, CC |

Explanation: An end of file has occurred reading
standard header control cards from tape
2x0y. The cards should be terminated by an
END control card.

Action: 1. If more control cards are to be read,
place them in the card reader, followed
by an END control card, and depress
Interrupt Key 252.

2. If no more control cards are to be read,
depress Interrupt Key 253. The program
will proceed as though an END card had
been read.

| A | 30280 | 30280-xy-ION |

Explanation: The I/O indicator on output tape 2x0y
has been left on.

Action: 1. To recheck, depress Interrupt Key 252.
It is assumed that a new tape has been
mounted. (1)

2. To turn indicator off and continue, de-
press Interrupt Key 253.

_____

(1)   If this loop/message occurs during the execution of CSHSK, all base tapes
will be rechecked.

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Type	Identification Code	Message, Explanation, Action
A	30281	30281-xy-ION

Explanation: The I/O indicator on input tape
2x0y has been left on.

Action: 1. To recheck, depress Interrupt Key
252. It is assumed that a new tape
has been mounted. (1)

2. To turn indicator off and continue,
depress Interrupt Key 253.

Type	Identification Code	Message, Explanation, Action
A	30282	30282-xy-PCT RCD 1

Explanation: A PCT has occurred in forward
spacing over the first record on output tape
2x0y. The PCT may be caused by two tape
dial settings specifying the same unit, or by
an incorrect density setting.

Action: 1. If duplicate dial settings exist, set
them correctly; then depress Interrupt
Key 252 to recheck. (1)
If it is suspected that the density is
set wrong, the density must be
changed at the tape drive. (If 729
Model V and VI tapes are used, it
may also be necessary to change the
setting of the density switch on the
7621 Tape Adapter Unit.) Depress
Interrupt Key 252 to recheck. (1)

2. To ignore the PCT and continue, de-
press Interrupt Key 253. The density
setting may be manually changed, if
desired, before continuing the program.

Type	Identification Code	Message, Explanation, Action
A	30283	30283-xy-PCT RCD 1

Explanation: A PCT has occurred in forward
spacing over the first record on input tape
2x0y. The PCT may be caused by two tape
dial settings specifying the same unit, or by an
incorrect density setting.

---

(1) If this loop/message occurs during the execution of CSHSK, all base
tapes will be rechecked.

Type	Identification Code	Message, Explanation, Action
		Action: 1. If duplicate dial settings exist, set them correctly; then depress Interrupt Key 252 to recheck. (1)

If it is suspected that the density is set wrong, the density must be changed at the tape drive. (If 729 Model V and VI tapes are used, it may also be necessary to change the setting of the density switch on the 7621 Tape Adapter Unit.) Depress Interrupt Key 252 to recheck. (1)

2. To ignore the PCT and continue, depress Interrupt Key 253. The density setting may be manually changed, if desired, before continuing the program.

| A | 30290 | 30290-xy-L |

Explanation: A standard or nonstandard header specified for output tape 2x0y is missing.
Action: 1. Mount a new reel on 2x0y; then depress Interrupt Key 252 to recheck. (1)
2. To accept the tape without a header, depress Interrupt Key 253. If a standard header is specified, IOCS will create a header for the tape; if a nonstandard header is specified, the specialized routine will develop the header.

| A | 30291 | 30291-xy-L |

Explanation: A standard or nonstandard header specified for input tape 2x0y is missing.
Action: 1. Mount a new reel on 2x0y; then depress Interrupt Key 252 to recheck. (1)
2. To accept the tape without a header, depress Interrupt Key 253. The record will be treated as a data record.

| A | 30293 | 30293-xy-L |

Explanation: The record following a tape mark on single-file input tape 2x0y is not a valid trailer.
Action: 1. To effect transfer to the End-of-Reel Transfer Address, depress Interrupt Key 252.
2. To effect transfer to the End-of-File Transfer Address, depress Interrupt Key 253.

(1) If this loop/message occurs during the execution of CSHSK, all base tapes will be rechecked.

	Identification	
Type	Code	Message, Explanation, Action
A	30295	30295-xy-L

Explanation: The record following a tape mark on multifile input tape 2x0y is not a valid label.

Action: 1. To effect transfer to the Header Transfer Address, depress Interrupt Key 252.

2. To effect transfer to the End-of-File Transfer Address, depress Interrupt Key 253.

A	30296	xxxx/xxxx-xxx xxxxxxxxxx xxxxx-xxx
		30296-xy-L

Explanation: No header has been specified for output tape 2x0y. However, the tape contains a standard header, a portion of which is typed as the first line of this message.

Action: 1. Mount a new reel on tape unit 2x0y; then depress Interrupt Key 252 to recheck. (1)

2. To accept the tape for output, depress Interrupt Key 253. No header will be created for the tape, and the standard header existing on the tape will be destroyed.

A	30298	xxxx/xxxx-xxx xxxxxxxxxx xxxxx-xxx
		30298-xy-L

Explanation: The retention cycle and creation date in the standard header label on output tape 2x0y indicate that the tape should not be written on at this time; or the creation date in the header is invalid. A portion of the header is printed as the first line of this message.

Action: 1. Mount a new reel on tape unit 2x0y; then depress Interrupt Key 252 to recheck. (1)

2. To accept the tape for output, depress Interrupt Key 253.

---

(1) If this loop/message occurs during the execution of CSHSK, all base tapes will be rechecked.

Type	Identification Code	Message, Explanation, Action
A	30299	xxx xxxxxxxxxx (C) or xxxx-xxx xxxxxxxxxx (FS)
		xxxx/xxxx-xxx xxxxxxxxxx xxxxx-xxx
		30299-xy-L

Explanation: The standard header label on input
tape 2x0y is incorrect.

If cycle checking is being used, the correct
reel sequence number, cycle number, and
file identification are typed as the first line
of the message. (This format occurs only
in CSHSK since the file serial check is added
for subsequent reels.) If file serial checking
is being used, the correct file serial, reel
sequence, cycle number (if any) and file
identification are typed as the first line of
the message.

A portion (including the incorrect fields) of the
header label which is actually on tape 2x0y
is typed as the second line of the message.

Action: 1. Mount the reel which contains the
correct header label (first line) on
tape unit 2x0y; then depress Interrupt
Key 252 to recheck. (1)

2. To accept the header label on tape 2x0y,
depress Interrupt Key 253. The file
serial, reel sequence and file identi-
fication fields in the file table will be
updated accordingly.

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(1) If this loop/message occurs during the execution of CSHSK, all base
tapes will be rechecked.

APPENDIX 1: RELATIONSHIP OF 7080 IOCS TO 705 III IOCS

Introduction

The 7080 IOCS has been specified to retain as high a degree of compatibility with the 705 III IOCS as possible. Changes have been made to permit the inclusion of improvements, and in some cases to accommodate machine hardware advancements.

A reassembly of object programs using the 705 III IOCS will be a necessary prerequisite to the use of the 7080 IOCS. This is due primarily to the desirability of using the TIP linkage rather than the RCVS-TSL type of linkage. Since the necessity of a reassembly was accepted by the users of the 705 III IOCS, it was felt that the channel tables and file tables should also be modified to permit improvements.

The macro-instruction headers and the execution of the requests initiated by functional linkages have remained basically the same. Exceptions are noted below and in the section of this manual which defines macro-instructions.

It was announced some time ago that the housekeeping priming function would be expanded to include the priming of the Get/Put work area. The final specification in this regard does not include the priming of the Get/Put work area. It will be necessary for the object programmer to execute an IOGET request for each of his files before entering his normal processing. This change will make the 705 III and 7080 IOCS compatible in this respect.

The 705 III IOCS Get/Put linkages in all cases included the address of the work area. The file table in the 7080 IOCS includes one work area address for Get/Put. A certain amount of efficiency may be gained in using only this work area. If it is necessary to use additional work areas, the Get/Put routine is expanded to handle this requirement. If the object programmer indicates that only one work area is used, the work area address given in the 705 III Get/Put linkages IOGET and IOPUT, operand X2, must be eliminated. A wasted assembly will result if there is a conflict in these concepts.

A number of 705 III IOCS users have expressed their desire to alternate reels of a file between tape transports attached to different channels. Although the variable format of the 7080 Tape Table (705 III IOCS Channel Tables) permits such alternation, it should be used only when absolutely necessary.

It will be necessary in converting from 705 III to 7080 ICCS to use the new Tape Table rather than the Channel Tables. This change may be accomplished by removing the existing Channel Table definitions and substituting definitions as required through the IOTA and IOTS macro-instructions.

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The file table changes may likewise be accomplished by deleting the old definitions and substituting the macro-instruction headers IOFTA, IOFTB and IOFTC, as required. The file tables have been changed to permit a more reasonable approach to the areas of Get/Put and input/output area definitions. The Get/Put system used with the 705 III IOCS was designed after the completion of the IOCS. The Get/Put functions are an integral part of the 7080 IOCS (the file tables in particular). The improvements to the file tables include:

1. The possible inclusion of both a Get and Put routine with any file table and the semi-automatic transition from output to input, i.e., IOPUT to IOGET or vice-versa through the macro-instructions IOMIP and IOMOP.

2. The generation of input/output areas including record length checking fields with the file table generation. It should be noted that the definition of input/output areas has been modified regarding record length checking requirements.

3. Improved statistical accounting of tape error occurrences according to IBM tape handling standards.

In the 705 III IOCS, it was necessary to include in each assembly as the first I/O macro-instruction the macro-instruction IODEF. This macro-instruction must be deleted and the macro-instruction IOCS inserted in its place.

The 705 III IOCS macro-instructions IODEF, IOHSK, IOSAS and IOSYS (having to do with the assembly of an IOCS) are unused in the 7080 IOCS.

Compatibility of 705 III IOCS and 7080 IOCS Macro-Instructions

The table on the next page summarizes the macro-instructions used in the 705 III IOCS and the 7080 IOCS according to the compatibility of header format and function. The handling of obsolete macro-instructions is indicated, as are new macro-instructions. This table should be used as a key to further study of changes to the system as noted in the section, "IOCS80 Macro-Instructions," and the latter portion of this section, "Conversion of Programs Using 705 III IOCS to 7080 IOCS."

In the following table, N indicates "NO," Y indicates "YES," and numbers in parentheses refer to notes following the table.

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Macro	Applies to 705 III IOCS	Applies to 7080 IOCS	Header Format Changed	Old Header Compatible	Function Changed
IOBSD	N	Y	--	--	--
IOBSF	Y	Y	Y	N	Y - Operation buffered
IOBSP	Y	Y(4)	N	Y	N
IOCLS	Y	Y	N	Y	N - (1)
IOCHK	Y	Y(4)	N	Y	Y - Only file specified is held
IOCS	N	Y	--	--	--
IODCH	N	Y	--	--	--
IODEC	Y	Y	Y	Y	Y - See Macro
IODEF	Y	N	--	N	Y - (2)
IODMP	Y	Y	N	Y	N
IOFER	Y	Y	N	Y	N - (1)
IOFSF	Y	Y	Y	N	Y - Operation buffered
IOFSP	Y	Y(4)	N	Y	N
IOFTA	N	Y	--	--	--
IOFTB	N	Y	--	--	--
IOFTC	N	Y	--	--	--
IOGET	Y	Y	Y	Y	Y - Work area need not be specified
IOGP	Y	N	--	N	Y - (2)
IOHLD	Y	Y	N	N(5)	Y - Only file specified is held
IOHSK	Y	N	--	N	Y - (2)
IOIGP	Y	N	--	N	Y - (2)
IOIOF	Y	Y	N	Y	N
IOION	Y	Y	N	Y	N
IOLNK to					
IOHSK	Y	Y	N	Y	N
IOMRD	Y	Y	N	Y	N
IOCHANTEST	Y	N	--	Y	Y - (2)
IOERR	Y	N	--	N	Y - (2)
IOEOF	Y	N	--	N	Y - (2)
ASUSAVE	Y	N	--	Y	Y - (2)
ASURESTORE	Y	N	--	Y	Y - (2)
IOMFC	Y	Y	N	N	Y - Will always write EOF trailer
IOMFO	Y	Y	N	Y	N
IOMIP	Y	Y	Y	Y	Y - See Macro
IOMOP	Y	Y	Y	Y	Y - See Macro
IOOPN	Y	N	--	N	Y - (2)
IOPOS	N	Y	--	--	--
IOPUT	Y	Y	Y	Y	Y - See Macro
IORET	N	Y	--	--	--
IORD	Y	Y	N	Y	N
IORDC	Y	Y(4)	N	Y	Y - (3)
IORDS	Y	Y	Y	Y	Y - Check length may be specified
IORUN	N	Y	--	--	--

Macro	Applies to 705 III IOCS	Applies to 7080 IOCS	Header Format Changed	Old Header Compatible	Function Changed
IORWD	Y	Y	N	Y	N
IOSAS	Y	N	--	N	Y - (2)
IOSYS	Y	N	--	N	Y - (2)
IOTA	N	Y	--	--	--
IOTS	N	Y	--	--	--
IOTYP	Y	Y	Y	Y	Y - See Macro
IOWR	Y	Y	N	Y	N
IOWRC	Y	Y(4)	Y	Y	Y - (3)
IOWRS	Y	Y	Y	Y	Y - Check length may be specified

Note 1: Tape may be rewound/unloaded, I/O Indicator will not be left on.
Note 2: Macro-instruction invalid with 7080 IOCS; must be removed from program.
Note 3: Record Length Checking must be specified in the file table.
Note 4: Included for compatibility only.
Note 5: If the second operand of this macro-instruction is omitted or blank, this will not cause a file to be opened by IOCS80.

Conversion of Programs Using 705 III IOCS to 7080 IOCS

The 7080 IOCS has been written so as to preserve compatibility with the 705 III IOCS as much as possible. Certain changes will have to be made, however, to 705 programs before they can be reassembled to run with the 7080 IOCS.

Major Changes

The first I/O macro-instruction in the program must be IOCS 705CONVERT口. The IOCS macro-instruction will call in the common entry points and will cause all subsequent I/O linkage macro-instructions to generate linkages to the 7080 IOCS rather than the 705 III IOCS.

The first operand of 705CONVERT will also cause each linkage macro-instruction to generate an ENT80, EEM, preceding the actual linkage, and a LEM, LEV80, following it. In addition, if the first operand of 705CONVERT is used and the program is not under control of ENT80, the IOTYP and IODEC macro-instructions will generate an ENT80, EEM, preceding the actual linkage, and a LEM, LEV80, following it. The IODEF macro-instruction must be removed.

The Channel Tables must be replaced by IOTA macro-instructions to generate the Tape Table; if the program makes any changes to the Channel

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Tables, as in phase-to-phase conversion, these changes must be replaced by the corresponding changes to the Tape Tables in accordance with the new format. If it is necessary to modify the Tape Table at object time, it will probably be advisable to assemble Tape Table components or alternate Tape Tables in input or output areas and move the desired table, or assemble components at actual location 000500 prior to the execution of CSHSK.

The file tables and IOGP macro-instructions must be replaced by IOFTA, IOFTB and IOFTC macro-instructions; any changes made to, or tests made of, the file tables must also be replaced by macro-instructions which will be provided for this purpose.

The EOR, EOF and Header Transfer Address routines may have to be modified to account for the fact that the 7080 IOCS will transfer to these exit points in 7080 mode, interrupt program, and with the starting point counter at 3000. This will probably require the addition of SPC, USB, LEM, EEM, SPC, LSB (but not LIP or TIP) instructions at the beginning or end of these routines as needed. CASUs 9, 13 and 14 may be used during the execution of these routines.

If record length checking is specified, the I/O areas must be rewritten to conform to the new standards. IORDC and IOWRC macro-instructions will generate the same linkage as IORD and IOWR macro-instructions, respectively. If record length checking is desired, it must be specified in the IOFTB and IOFTC macro-instructions.

Changes to Specific Linkage Macro-Instructions

IOMFC	The 7080 IOCS will always interpret an IOMFC linkage as requesting that an EOF trailer be written. Therefore, all IOMFC macro-instructions which are addressed to a file specifying sequential handling, must be changed to an IOMFO macro-instruction.
IOGET, IOPUT	IOGET and IOPUT linkages may destroy the setting of the starting point counter. Therefore, if the program requires that the contents of the accumulator be available after an IOGET or IOPUT, the macro-instruction must be modified by the addition of a third or fourth operand, respectively, of SAVE. Note also that the first operand of an IOGET or IOPUT macro-instruction must be the tag of an IOFTA macro-instruction and not an actual address.
IOHLD	The execution of the IOHLD function has been modified so that only the file named in the linkage will be affected. If all operations for that file have been completed and checked, no other action will be taken. The stacking table will be cleared of all requests for the named files. This differs from

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	705 III IOCS in that all channels were previously stopped by the IOHLD request. In order to open a tape file, the IOHLD macro must have a second operand of OPEN.
IOCHK	The IOCHK macro-instruction will produce an IOHLD linkage.
IOLNK to CHANTEST	Because of the interrupt feature of the 7080, this linkage is no longer meaningful. No linkage will be generated.
IOBSF, IOFSF	The execution of these requests may be buffered with the 7080 IOCS. If these requests must be completed prior to a return to the object program, a second parameter of HOLD should be added to these headers.

Other Comments

All tapes, which in the 705 III IOCS were rewound and left with the indicator on (as at EOF), will be rewound and unloaded by the 7080 IOCS.

The 7080 IOBSP routine has been improved so that if an IOBSP linkage is given after an EOF is recognized, but before all input areas have been processed, IOCS will recalculate the number of backspaces to be performed so as to correctly reposition the tape.

The 705 III IOCS made extensive use of ASUs 1 through 5, and set these ASUs accordingly. Since the 7080 IOCS does not use Storage Banks 0 and 1, the ASUs will not be set by CSHSK.

Users of 705 III IOCS who incorporated the Get/Put system into their programs should note the following improvements in the timing relationship between the Get/Put routines and the IOCS end-of-file and end-of-reel routines:

In 705 III IOCS, one data record remained to be processed by the object program when an IOCS exit was made at end of file (End-of-File Transfer Address). In the 7080, IOCS will not exit at end of file until the last data record is processed, or at end of reel, except when Mode 1 is specified. Therefore, the Model III end-of-file routines must be modified to reflect this change.

The versions of 7080 IOCS available to the programmer may be classified as follows: (1)

1.   IOCS80 – Complete version for four-channel 7080.

2.   IOCS82 – Complete version for two-channel 7080.

3.   IOMS80 – Minimal version for four-channel 7080.

4.   IOMS82 – Minimal version for two-channel 7080.

The taking of checkpoints is optional with IOMS80 and IOMS82. Thus, there are actually six distinct versions of 7080 IOCS available to the programmer.

IOCS80

This version of IOCS is available in preassembled form, and is the version described in this manual. IOCS80 contains all the features and options in IOCS, and will perform all IOCS functions for a four-channel 7080.

IOCS80 occupies memory positions 000500 through approximately 020000. Memory positions 020000 to approximately 023500 contain erasable House-keeping.

IOCS82

This version of IOCS is identical to IOCS80, except that it operates only on channels 20 and 21. Routines for channels 22 and 23 have been deleted.

(1)   The material listed below is available upon request from DP Program Information Department, IBM, 112 East Post Road, White Plains, N.Y. One full reel of tape must accompany the request.

        a. Library of macro-instructions and subroutines for use with 7080 IOCS.

        b. Reassembly Master Tape for IOCS80.

        c. Change Decks for Reassembly Master Tape to secure an updated IOCS80, IOCS82, IOMS80 and IOMS82.

        d. Preassembled deck for IOCS80.

        e. Listing of IOCS80.

IOCS82 may be obtained through use of the Reassembly Master Tape with the Change Deck for IOCS82.

IOCS82 will be located in memory from 000500 to approximately 018000. Memory positions 020000 to approximately 023500 will contain erasable Housekeeping.

IOMS80

This version of IOCS is provided for programmers wishing a much smaller package. It requires approximately 6000 memory positions less than IOCS80.

IOMS80 will handle input/output functions for a four-channel 7080, but will require an adherence to certain specifications, and the foregoing of certain options. IOMS80 differs from IOCS80 in the following ways:

1. Standard trailers must be used.

2. Single-file tapes must be used.

3. Stacking mode is assumed.

4. Get/Put must be used for input/output functions.

5. Mode 2 end-of-reel handling is assumed for input tapes; Mode 1 end-of-reel handling is assumed for output tapes.

6. Special macro-instructions may not be used. In addition to the descriptive macro-instructions (IOCS, IOFTA, IOFTB, IOFTC, IOTA, IOTS), only the following macro-instructions may be used with IOMS80: IOLNK, IOGET, IOPUT, IOHLD, IOTYP, IODEC, IORET, IOMIP, IOMOP, IOION, IOIOF.

7. Error records may not be dumped.

8. Messages may not be written on tape.

9. Alternation of tapes between channels is not permitted.

10. Loop/message options may not be prespecified. All messages are assumed to be Type A, regardless of the Message Type Code indicated. The IODCH macro-instruction must not be used.

11. Certain coding in IOCS, provided for the detection and correction of object program errors, has been deleted. For example, improper linkages, improperly defined input areas, improper operations, will not be detected.

12. Priming, sequential handling, and rewind of tapes in Housekeeping is assumed.

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The taking of checkpoints (CSMRD) is optional with IOMS80. Therefore, if CSMRD is not included in IOMS80, the IOLNK macro-instruction with operand CSMRD or CSMRS may not be used.

IOMS80 may be obtained through use of the Reassembly Master Tape with the Change Deck for IOMS80. To include the taking of checkpoints in IOMS80, all cards with a "C" in column 74 must be removed from the Change Deck.

IOMS80 will be located in memory from 000500 to approximately 014000. Memory positions 014000 to approximately 017500 will contain erasable Housekeeping. If CSMRD is included, IOMS80 will require approximately 1500 more memory positions.

IOMS82

This version of IOCS is identical to IOMS80, except that it operates only on channels 20 and 21. Routines for channels 22 and 23 have been deleted.

IOMS82 may be obtained through use of the Reassembly Master Tape with the Change Deck for IOMS82. To include the taking of checkpoints in IOMS82, all cards with a "C" in column 74 must be removed from the Change Deck.

IOMS82 will be located in memory from 000500 to approximately 012000. Memory positions 012000 to approximately 015500 will contain erasable Housekeeping. If CSMRD is included, IOMS82 will require approximately 1500 more memory positions.

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APPENDIX 3: RELOCATION OF IOCS

Introduction

This section provides the necessary information for programmers wishing to relocate IOCS in memory, particularly those with programs operating in memory positions occupied by the preassembled IOCS.

If it is desired to divide the IOCS in several blocks, care must be taken not to separate related instructions or work areas. The cards from AA07 to AK23 (actual locations 000500-001400 in the preassembled deck) must always be treated as a block.

If the IOCS is to be located above 40000 for possible use with object programs operating in 705 II mode, or is to be located above 80000 for possible use with object programs operating in 705 III mode, the four instructions from AJ24 to AJ28 must be located below 40000 or 80000, respectively. An RCD 20 should be inserted to replace these cards.

Memory Location Cards

The memory location of IOCS is controlled by three cards in IOCS80 (AA05, AA06, and EP02). Also related to the memory location of IOCS are four cards in the library of macro-instructions and subroutines (IOTS, A08; CSAAA, A03; CSAB, A03 and A39).

IOCS80 - AA05

This LITOR card must be changed if the programmer wishes to relocate the IOCS literals in memory.

IOCS80 - AA06

This LASN card must be changed if the programmer wishes to relocate the non-erasable portion of IOCS.

IOCS80 - EP02

This LASN card must be changed if the programmer wishes to relocate erasable Housekeeping.

IOTS - A08

This SASN card must be changed to specify the actual left-hand address of IOCS tag CSW18.

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<u>CSAA - A03</u>

This SASN card must be changed to specify the same actual address as IOCS80 card AA06. This subroutine corresponds to IOCS80 Index Numbers AA07 through AK23, and contains the common linkage points, work areas and control information which must be included in an object program. They should be treated as a block in any relocation. If the IOCS being used contains the checkpoint routines, this block may not be relocated in the last 20000 positions of memory.

<u>CSAB - A03 and A39</u>

These SASN cards need be changed only if IOCS message options or the IODCH macro-instruction is used. Card A03 specifies the actual left-hand address of IOCS tag CSC0093. Card A39 specifies the actual left-hand address of IOCS tag CSA028005.

If this subroutine is used, no IOCS message should be changed in the reassembly.

This subroutine may <u>not</u> be used with the minimal IOCS.

<u>Example of Relocating IOCS</u>

Let us assume the user wishes to relocate IOCS in memory beginning at position 80500, for possible use with programs which may leave eighty mode. In this case, the following reassembly change cards should be punched:

AA04	ENT80	(1)	
AA05	LITOR		@99775
AA06	LASN		@80500
AJ23A	RCD	20	
AJ23B	SASN		@19980
AJ28A	LASN		
EP02	LASN		@100000

In addition, the following changes must be made to the library:

<u>TO IOTS</u>

| A08 | SASN | @80705 |

<u>TO CSAAA</u>

| A03 | SASN | @80500 |

<u>TO CSAB</u>

| A03 | SASN | @81400 |
| A39 | SASN | @100000 |

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(1) This card must be included with reassembly input, to insure proper treatment of actual addresses.

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